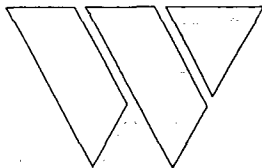




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Companies, INC.



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REMEDIAL INVESTIGATION/FEASIBILITY STUDY WORK PLAN

**FIELD OPERATIONS PLAN
ROCKAWAY BOROUGH WELL FIELD SITE
OPERABLE UNIT #3
FOR PROPERTY OF
KLOCKNER & KLOCKNER
ROCKAWAY BOROUGH, NEW JERSEY**

**PART 1 - SAMPLING AND ANALYSIS PLAN
PART 2 - QUALITY ASSURANCE PROJECT PLAN**

SUBMITTED TO:

**USEPA - REGION II
EMERGENCY & REMEDIAL RESPONSE DIVISION
NEW YORK, NEW YORK**

SUBMITTED BY:

**THE WHITMAN COMPANIES, INC.
EAST BRUNSWICK, NEW JERSEY**

ON BEHALF OF KLOCKNER & KLOCKNER

IN ACCORDANCE WITH:

**ADMINISTRATIVE ORDER ON CONSENT
INDEX NO. II-CERCLA-95-0104**

JUNE 1997

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PART 1 - SAMPLING AND ANALYSIS PLAN

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VOLUME 2

Quality Assurance Manual - Envirotech Research, Inc.

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PART 1 - SAMPLING AND ANALYSIS PLAN

1.0 INTRODUCTION

This Field Operations Plan (FOP) has been prepared by Whitman Companies, Inc. on behalf of Klockner & Klockner (Klockner) as part of the Remedial Investigation/ Feasibility Study (RI/FS) Work Plan, in accordance with Chapter VIII, Paragraph 28 of the Administrative Order on Consent (AOC) entered into by Klockner and the United States Environmental Protection Agency (EPA) and Task I, Item C of the Statement of Work (SOW) (USEPA, 1995).

This FOP is composed of two parts. Part 1 is a Sampling and Analysis Plan (SAP) which details sampling activities and procedures to be conducted under the RI/FS for the Rockaway Borough Wellfield Site - Operable Unit #3 at Block 5, Lots 1 and 6, and Block 7, Lots 7 and 8, in the Borough of Rockaway (Klockner Property). Part 2 is a Quality Assurance Project Plan (QAPP), which summarizes data usage, analytical parameters and QA/QC requirements for sample collection and analysis.

This revised FOP incorporates responses to EPA's March 20, 1997 comments concerning the May 1996 Field Operations Plan submitted by The Whitman Companies, Inc. on behalf of Klockner. Changes made in the text of this report are presented in **BOLD** letters.

2.0 SITE BACKGROUND

2.1 Klockner Property Location

The Klockner Property is located at the intersection of Stickle Avenue and Elm Street in the north end of the Borough of Rockaway in Morris County, New Jersey. The Klockner Property is a portion of the Rockaway Borough Well Field Site (Site), which itself encompasses approximately 2.1 square miles. See Figure 2.1 for the Klockner Property

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location on a U.S.G.S. Dover, N.J. quadrangle. A site map of the Klockner Property is included as Figure 2.2.

The Rockaway Borough well field is located approximately 600 feet southwest of the Klockner Property. The location of the Rockaway Borough well field and the Klockner Property are indicated on Figure 2.3.

The Klockner Property consists of two separate properties. One of the properties is located north of Stickle Avenue and is currently owned by Klockner. This portion of the Klockner Property Block 5, Lots 1 and 6, has been known for many years as the Building 12 Property, and will be referred to as such in this report. The second portion of the Klockner Property is located south of Stickle Avenue and consists of Block 7, Lots 7 and 8. This portion of the Klockner Property has been known as the Building 13 Property and will be referred to as such in this report. Lot 7 is currently owned by Norman Iverson and operated by F.G. Clover Co. Lot 8 is currently owned by Klockner and is used as parking for Building 12 tenants. However, Lot 8 of the Building 13 Property historically has been associated with Lot 7 and the operations thereon. Accordingly, Lot 8 will be discussed as part of the Building 13 Property, even though it is now owned by Klockner.

The Building 12 Property consists of 1.34 acres. The majority (approximately 93%) of the Building 12 Property is covered by building structures and pavement. The building structure consists of approximately 50,000 square feet of one and two story space used for manufacturing, office space and storage. The Building 12 Property is bordered to the south by Stickle Avenue, to the west by Oak Street and residential housing, to the north by Ford Road and to the east by Elm Street.

Lot 7 of the Building 13 Property consists of approximately 1.07 acres, and Lot 8 consists of approximately 0.5 acres. There are two building structures present on Lot 7 of the Building 13 Property. Lot 8 is a partially paved area with no structures. The building coverage of the Building 13 Property site is approximately 12,400 square feet. Approximately 50% of Building 13 Property is covered by building structures and pavement. The Building 13 Property is bordered to the north by the Building 12 Property (across Stickle Avenue), to the west by residential properties (across Elm Street), to the south by residential property, and to the east by a railroad line.

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2.2 Site History

The Site is a municipal well field that serves approximately 10,000 people. The Rockaway Borough's three water supply wells (#1, 5 and 6) draw water from an unconsolidated glacial aquifer from a depth ranging from 54 to 84 feet below grade. The supply wells are located off of Union Street and are southwest of the Klockner Property.

Contamination of the Site groundwater was first discovered in 1979. The primary contaminants identified were Trichloroethylene (TCE) and Tetrachloroethylene (PCE). Several inorganic contaminants, including Chromium, Lead and Nickel, were also identified. In December 1982, the Site was placed on the EPA's National Priorities List of Superfund sites.

Following discovery of ground water contamination, NJDEP conducted an RI/FS (SAIC, 1986), which was known as Operable Unit 1 (OU1), and EPA conducted a second RI/FS (ICF, 1991a and b), which was known as Operable Unit 2 (OU2). Through these studies, the Klockner Property was identified as one of the potential source areas of the Site contamination.

The investigation of soil and ground water contamination was initiated at the Building 12 portion of the Klockner Property in 1986 under New Jersey's Environmental Cleanup Responsibility Act (ECRA). The ECRA investigation was conducted under oversight of the New Jersey Department of Environmental Protection (NJDEP). Soil and ground water contamination were detected, consisting primarily of chlorinated volatile organic compounds. The Klockner's withdrew from the ECRA program in 1990 but continued to investigate the source of TCE and PCE contamination in soil through January 1992.

The remediation of the plume of groundwater contamination originating from the Klockner Property area is being addressed by Thiokol Corporation pursuant to a Consent Decree entered into between it and EPA in 1994. An RI/FS of contaminated soils at the Klockner Property is being addressed by Klockner in accordance with the October 1995 AOC and SOW.

A detailed description of the site and surrounding areas and an analysis of existing data are included in the First Amended Summary Report, which is being submitted concurrently to USEPA.

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3.0 SAMPLING OBJECTIVES

Objectives of the sampling effort detailed in this document are listed below:

1. Identify, characterize and delineate potential source areas identified through previous sampling activities conducted at the Building 12 Property. This will be accomplished by conducting a soil gas survey followed by the installation of soil borings and the collection and analysis of soil samples.
2. Identify, characterize and delineate potential source areas at the Building 13 portion of the Klockner Property. This will be accomplished by conducting a soil gas survey followed by the installation of soil borings and the collection and analysis of soil samples.
3. Supplement the geological characterization of the site by collecting select soil samples for grain size analysis and organic carbon content.
4. Satisfy outstanding sampling requirements identified by NJDEP in its comments dated January 12, 1990.

In conjunction with previously collected data, the collected information will be used to:

- conduct a Risk Assessment (by USEPA);
- conduct an evaluation of potential remedial alternatives;
- aid in estimating the volumes of impacted soil.

4.0 SAMPLE LOCATION, FREQUENCY AND DESIGNATION

4.1 Sample Location and Frequency - Building 12 Property

A total of approximately 40 soil gas sampling locations will be field screened for the presence of contamination. Based on the results, soil samples will be collected and analyzed as warranted.

Soil samples will also be collected for area specific parameters from eleven (11) potential areas of environmental concern. Locations were selected to provide representative coverage of the specific potential Areas of Environmental Concern (AECs) identified and

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the characterization of these areas. The proposed sample locations are indicated on Figures 4.1 and 4.2. Sample designations are listed in Tables 1A and 1B.

Soil gas survey samples will be collected and analyzed for one of the following parameters depending on the AEC:

- GC Purgeable Halocarbons (PHAL) by EPA Method 8010;
- GC Volatile Organics Compounds by EPA Methods 8010 & 8020.

The soil samples will be collected and analyzed for all or certain of the following parameters, depending on the AEC:

- GC Purgeable Halocarbons (PHAL) by EPA Method SW-846 8010;
- GC/MS Volatile Organic Compounds with +10 Library Search (VOCs) by EPA Method SW-846 8240;
- GC/MS Base/Neutral Extractable Organic Compounds with +15 Library Search (BNs) by EPA Method SW846 8270;
- **Mercury by EPA method SW846 7471A;**
- Target Analyte List (TAL) Metals by appropriate EPA Methods SW-846 6010 & 7000; and
- Cyanide as specified in the CLP SOW Methodology for Inorganic Analysis Multi-Media, Multi-Concentration, document ILM03.0;
- Petroleum Hydrocarbons (PHC) by EPA Method 418.1 modified for soils **with soxhlet extraction.**

The purpose for collecting soil gas samples for EPA Method 8010 analysis in certain areas and both EPA Methods 8010 and 8020 and collecting soil samples for SW846 8010 in certain areas and SW846 8240 in others is based on the historical sampling results for the Building 12 Property. For example, previous samples collected for volatile organics by SW846 8240 indicated the presence of Purgeable Halocarbons in the alleyway area of environmental concern. Therefore, soil gas sample analysis for Purgeable Halocarbons by EPA Method 8010 and soil samples by SW846 8010 are proposed. No sampling has been conducted to investigate the former north drum storage area. Therefore, soil gas sample analysis by EPA Methods 8010 and 8020 and soil sample analysis by SW846 8240 are proposed for this area.

Soil gas samples will be collected from 1/2 inch holes created by using a manual slide hammer or drive rod. Soil samples for laboratory analysis will be collected using a push sampling devise, such as a Geoprobe. In some areas, a hole will have to be drilled through

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concrete to allow for sample collection. Hand augers will be used to collect samples from areas not accessible by larger sampling equipment. Each six-inch interval will be visually examined for the presence of residual staining and screened with a PhotoVac TIP. When a predetermined depth has not been identified for analysis by prior sampling in AECs, the interval with obvious staining or with the highest PhotoVac TIP reading will be selected for laboratory analysis. **If all samples in a given boring appear to be the same, the sample for Non-volatile Organics will be collected from the 0 to 6 inch interval below grade or paving. The sample for VOCs or PHAL will be collected from a depth of 18 to 24 inches below grade or paving. In areas where two sample depths are proposed, the second sample depth will be collected from the 6 inch interval above ground water.**

Soil samples for laboratory analysis for VOCs and PHAL will be collected in accordance with NJDEP's field Methanol extraction method. A description of this procedure is provided as Appendix H.

During soil boring installation, the types of soils encountered will be recorded in order to evaluate contaminant migration and evaluate remedial alternatives. In order to supplement the geological characterization of the site, four (4) soil samples will be collected for grain size analysis and organic carbon content. Additional samples for these analyses may be collected based on field observations of subsurface soil types. All sampling will be performed in conformance with the New Jersey Technical Requirements for Site Remediation, N.J.A.C. 7:26E.

Air monitoring with a PhotoVac TIP will be conducted during sampling activities as part of the Health and Safety Plan.

Field Blanks will be collected at the rate of one per day or at a rate of 10% of the total number of samples collected throughout the event. **Trip Blanks will be collected at a rate of one per sample shipment (not to exceed two consecutive field days). Blank water will be provided by the analytical laboratory. The blank water for VOCs and PHAL is prepared by deionizing water, passing it through a carbon scrubber, an organic scavenger and a nitrogen purge. Field blank water for other parameters is prepared by deionizing water and passing it through a MilliQ filter. The blank water is analyzed daily by the laboratory. Typical blank water analytical data is included in Appendix G. Duplicate samples are to be included for each matrix at a minimum rate of one for every twenty samples and be submitted to the lab as "blind" samples. If less than twenty samples are collected during a particular sampling episode, one duplicate will be performed.**

Sampling will be conducted as detailed below:

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4.1.1 Underground Gasoline Tank

The collection and analysis of two soil samples for Volatile Organic Compounds + 10 (VOC) will be conducted to satisfy NJDEP's January 12, 1992 comments. **The samples will include analysis for Lead to meet current NJDEP requirements for soil sampling at potentially leaded gasoline tanks.** The samples will be collected from beneath the tank fill material along the former tank center line.

4.1.2 Waste Oil Tank

Two soil samples will be collected to investigate the horizontal extent of the chlorinated volatile organic compounds (CVOC) formerly detected at a depth of 7 - 7.5 feet on the east and south sides of the former tank excavation. Based on the previous analytical results obtained under the ECRA program, the samples collected at this AEC will be analyzed for Purgeable Halocarbons (PHAL). One of the samples will include analysis for TAL Metals, due to the presence of metal contamination in the ground water in this area at levels above NJDEP's Ground Water Quality Standards (GWQS).

Shallow TCE soil contamination has also been detected in this area (see Item 4.1.6 Alleyway) and the proposed samples will also be used for the investigation of the Alleyway.

4.1.3 Catch Basin/Storm Sewer

A soil sample will be collected from previous sample location SS-8 for Base/Neutral Extractable Organic Compounds + 15 (BNs) and TAL Metals analysis to determine if further remediation is warranted in accordance with N.J.A.C. 7:26E. The sample will be collected from a depth of 2 - 2.5 feet.

4.1.4 Leaching Pit

Metals contamination was detected in the shallow groundwater in this area at levels above the current NJDEP GWQS. Therefore, a sample will be collected from previous sample location SS-25 for TAL Metals. The sample will be collected from a depth of 12 - 12.5 feet.

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4.1.5 Degreaser Pit

A soil sample will be collected for PHAL analysis from the area showing the highest soil gas concentrations during a previous soil gas survey (soil gas samples VD-13 and VD-14). **The sample will include analysis for TAL Metals.** The sample will be collected from a depth of 2.5-3 feet.

4.1.6 Alleyway

This area will include the alleyway, adjacent quonset hut and indoor area between the alleyway and degreaser pit. **Prior sample results indicated potential surface discharges as a source of contamination.** CVOCs were detected in the soil and soil gas in this area during previous sampling events. As the VOC contaminants previously detected consist of chlorinated compounds, soil gas samples for PHAL analysis in a mobile laboratory will be collected from this area. Approximately 20 to 30 samples will be collected from a grid. One (1) sample will be collected from each location from a depth of 3 feet. The sample grid will be set up as indicated in Figure 5.1.

The 3 foot soil gas sampling interval in the Alleyway and Quonset Hut is proposed to identify locations for soil samples within the contaminated zone and determine appropriate locations for soil samples to delineate the horizontal extent of the TCE and PCE contamination in these areas. A depth of 3 feet for the soil gas sample collection is based on recommendations from the soil gas survey contractor, Target Environmental Services, Inc., which has extensive experience in soil gas surveys. Target recommends collecting soil gas samples from a depth ranging from 3 to 5 feet based on site conditions. As the areas identified on the Building 12 Property are covered by pavement or building structures, which limit vertical movement of soil gas, the shallower depth of 3 feet is proposed.

The results of the soil gas survey will be evaluated to determine the appropriate locations for soil samples to characterize and delineate the PHAL contamination. **The sample locations identified for laboratory analysis will include two locations exhibiting elevated soil gas readings to characterize the contaminant concentrations for the risk assessment, and samples at locations exhibiting soil gas concentrations lower than in the known contaminated area to delineate the extent of the contamination.** It is anticipated that up to seven (7) boring locations will be installed to collect soil samples for laboratory analysis. Samples will be collected from a minimum of two (2) depths from the borings. The sample collection depths will be determined by field screening with a portable photoionization detector. **The sample depth exhibiting the highest field reading will be submitted. When field readings decrease with depth to water table, the second sample will**



be collected below this sample from a depth exhibiting the lowest reading. If field readings increase with depth to the groundwater, the first sample will be collected at the 0 to 6 inch interval above ground water and the second sample will be collected from a depth of 18 to 24 inches.

4.1.7 Scale Room

A scale is located in the center of the room. The underside of the scale will be inspected to determine if a drain is located below it. Any sludge found will be removed and properly disposed. Soil gas samples will be collected in this area as part of the soil gas survey for the Building 12 Property. The results of the soil gas survey will be used to select soil sample locations for horizontal delineation of the VOC contamination previously detected. Three (3) borings will be installed to collect soil samples to define the limits of the CVOC contamination previously detected in this area. One (1) boring will be installed at the location of prior sample "Funnel Area" to define the vertical extent of the CVOC contamination. A soil sample will be collected at a depth determined by field screening for laboratory analysis. The other two (2) boring locations will be based on the soil gas survey. A soil sample will be collected from these two borings at a depth just below the concrete floor to define the horizontal limits of the contamination. The soil samples will be analyzed for PHAL.

4.1.8 Quonset Hut

See Item 4.1.6 Alleyway.

4.1.9. Drum Storage Shed

A soil sample will be collected from the soil below the location of the former drum storage shed. The sample will be analyzed for PHCs, VOCs, BNs, and TAL Metals. The sample will be collected from a depth of 0 to 6 inches below paving material. The sample for VOCs analysis will be collected from a six inch interval at a location between 0 to 2 feet below paving material to be determined by field screening with a photoionization detector.

4.1.10 Drum Storage in Alleyway

A soil sample will be collected from the soil below the reported location of the spilled material (cyanide containing solution and lead tin solution) resulting from historical drum storage in the alleyway. The sample will be analyzed for TAL Metals and Total Cyanides. The sample will be collected from a depth of 0 to 6 inches below paving material.



4.1.11 North Drum Storage Area

A soil gas survey will be conducted to determine if CVOCs have been discharged in this area. The soil gas samples will be field analyzed for VOC. The soil gas sample grid will be set up as indicated in Figure 4.3. The soil gas samples will be collected from a depth of 3 feet and field analyzed for VOCs.

The 3 feet soil gas sample depth is proposed as discharges from drum storage would exhibit highest contaminant concentrations near the surface. The soil gas sample is collected from the gasses which have reached equilibrium in the soil column, and the highest concentrations of soil gas tend to collect below the paved surface. (See Item 4.1.6. - Alleyway for sample depth rationale.)

Soil samples for laboratory analysis will be collected from one to two locations based on the soil gas survey results. The soil sample will be analyzed for PHCs, VOCs, and TAL Metals. The sample will include analysis for BNs if PHC contamination is detected above 100 mg/kg. **Sufficient sample materials will be obtained for all possible BN samples, delivered to the laboratory and held pending PHC results.** The soil sample(s) will be collected from a depth of 0 to 6 inches below paving material. The sample for VOCs analysis will be collected from a six inch interval at a location between 0 to 2 feet below paving material to be determined by field screening with a photoionization detector. **If evidence of multiple "hot spots" exhibiting significant concentrations of VOCs are detected, then two (2) soil samples for VOCs will be collected. Based on evaluation of the soil sample results with the soil gas survey results, additional samples for VOCs will be collected.**

4.1.12 Sump

A soil sample will be collected from a depth of 1 to 1.5 feet below the sump invert. The soil sample will be analyzed for PHCs, VOCs, and TAL Metals. The sample will include analysis for BNs if PHC contamination is detected above 100 mg/kg. **The laboratory will analyze the PHC sample on an expedited basis. Instructions to expedite the sample will be included on the chain-of-custody. The results will be available prior to the 14-day extraction holding time for BNs.**

4.2 Sample Location and Frequency - Building 13 Property

A total of between 40 and 60 soil gas sampling locations will be field screened for the presence of contamination and **a minimum of four (4) confirmation** soil samples will be



collected and analyzed (details are provided below.) Locations were selected to provide representative coverage of the specific AECs identified and the characterization of these areas. **Four (4) soil samples also will be collected for Purgeable Halocarbons at the areas of potential environmental concern where the type of area is strongly suspected to have experienced a potential discharge from historic operations prior to those of F.G. Clover's. These areas include the oil storage shed, the storm drain, the pipe and the basement floor drain.** The proposed soil gas and soil sample locations are indicated on Figure 4.3. Sample designations are listed in Tables 3A and 3B.

The soil gas survey samples will be collected and analyzed for the following parameters:

- GC Purgeable Halocarbons by EPA Method 8010.

If soil sampling is indicated, the samples will be collected and analyzed for all or a portion of the following parameters depending on the AEC:

- GC Purgeable Halocarbons by EPA Method SW-846 8010;
- GC/MS Volatile Organic Compounds with + 10 Library Search by EPA Method SW-846 8240;
- GC/MS Base/Neutral Extractable Organic Compounds with + 15 Library Search by EPA Method SW846 8270;
- **Mercury by EPA Method SW846 7471A;**
- Target Analyte List Metals by appropriate EPA Methods SW-846 6010 & 7000; and
- Petroleum Hydrocarbons (PHC) by EPA Method 418.1 modified for soils **with soxhlet extraction.**

The soil gas and soil samples at Building 13 will be analyzed by EPA Method 8010 and SW846 8010 respectively, Purgeable Halocarbons. This method is proposed as the contaminants of concern in the groundwater at the Building 13 Property are the Purgeable Halocarbons TCE and PCE. Sample analysis by SW846 8240 is not proposed at this time.

Soil gas samples will be collected from 1/2 inch holes created by using a manual slide hammer or drive rod. Soil samples for laboratory analysis will be collected using a push sampling devise, such as a Geoprobe. In some areas, a hole will have to be drilled through concrete to allow for sample collection. Hand augers will be used to collect samples from areas not accessible by larger sampling equipment. Each six-inch interval will be visually examined for the presence of residual staining and screened with a PhotoVac TIP. When



a predetermined depth has not been identified for analysis by prior sampling, the interval with obvious staining or with the highest PhotoVac TIP reading will be selected for laboratory analysis. **If all samples in a given boring appear to be the same, the sample for Non-volatile Organics will be collected from the 0 to 6 inch interval below grade or paving. The sample for VOCs or PHAL will be collected from a depth of 18 to 24 inches below grade or paving. In areas where two sample depths are proposed, the second sample depth will be collected from the 6 inch interval above ground water.**

Soil samples for laboratory analysis for VOCs and PHAL will be collected in accordance with NJDEP's field Methanol extraction method. A description of this procedure is provided as Appendix H.

During soil boring installation, the types of soils encountered will be recorded in order to prepare a geologic cross-section of the property, evaluate contaminant migration and evaluate remedial alternatives. In order to supplement the geological characterization of the site, samples will be collected for grain size analysis and organic carbon content. The number of samples collected for these analyses will be based on the results of the soil gas survey. All sampling will be performed in conformance with the New Jersey Technical Requirements for Site Remediation, N.J.A.C. 7:26E.

Air monitoring with a PhotoVac TIP will be conducted during sampling activities as part of the Health and Safety Plan.

Field Blanks will be collected at the rate of one per day or at a rate of 10% of the total number of samples collected throughout the event. **Trip Blanks will be collected at a rate of one per sample shipment (not to exceed two consecutive field days). Blank water will be provided by the analytical laboratory. The blank water for VOCs and PHAL is prepared by deionizing water, passing it through a carbon scrubber, an organic scavenger and a nitrogen purge. Field blank water for other parameters is prepared by deionizing water and passing it through a MilliQ filter. The blank water is analyzed daily by the laboratory. Typical blank water analytical data is included in Appendix G. Duplicate samples are to be included for each matrix at a minimum rate of one for every twenty samples and be submitted to the lab as "blind" samples. If less than twenty samples are collected during a particular sampling episode, one duplicate will be performed.**

Sampling will be conducted as detailed below:

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4.2.1 Underground Heating Oil Tanks

The exact location of the two former underground heating oil tanks is not known. Soil gas samples will be collected in the vicinity of the location of the two underground tanks. **The proposed sampling grid is sufficient to screen this area although the exact tank locations are not known.** The samples will be collected as part of the soil gas survey described below. If the soil gas survey indicates that a tank location is a potential source area, then a soil sample will be collected for PHAL laboratory analysis. The sample would be collected from beneath tank fill material if encountered.

4.2.2 Dry Well

Confirmation from NJDEP that they did not require any further actions at the dry well area has been requested and will be provided to EPA when obtained. Based on the activities already conducted in this area (dry well and groundwater sampling and closure of the dry well) and the fact that the dry well was installed by Mr. Iverson after he purchased the property in 1981, after the contamination of the Rockaway Borough Wells was discovered, no further actions are recommended. A soil gas sample is proposed for this area to determine if a source of TCE or PCE is present. If the results of the soil gas survey indicate a source of TCE or PCE in this area, the further investigation of the dry well will be conducted.

4.2.3 Soil Gas Survey

A soil gas survey will be conducted to identify potential source areas for TCE and PCE contamination previously detected in soil gas and ground water samples collected at the Building 13 Property. Sample analysis will be for PHAL in a field laboratory. The samples will be collected from a property-wide sampling grid with nodes spaced at 50 feet intervals. Samples will be placed near potential areas of concern, **including underground utilities** where applicable. The samples will be collected from a depth of 4 feet. **A depth of 4 feet for the soil gas sample collection was based on recommendations from the soil gas survey contractor, Target Environmental Services, Inc., which has extensive experience in soil gas surveys.** Target recommends collecting soil gas samples from a depth ranging from 3 to 5 feet based on site conditions. As a majority of the soil gas sample locations proposed on the Building 13 Property are located in unpaved areas, which allows the escape of soil gas from the soils close to the surfaces, a depth of 4 feet is proposed. The sample grid and proposed sample locations are presented in Figure 4.3.

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If the results of the site-wide soil gas survey indicate the presence of PHAL, further soil gas sampling will be conducted in the areas with the highest soil gas concentrations. A grid will be established and soil gas samples will be collected at two (2) depths to be determined in the field. The soil gas samples will be analyzed for PHAL.

A minimum of four (4) soil gas sample locations (10% of the minimum number of soil gas samples proposed) will include collection of confirmatory soil samples for PHAL analysis. The soil samples will be collected from areas with low and high soil gas results. The soil samples will be collected from a depth to be determined by field screening with a photoionization detector and field observations. In the case of consistent field observations with depth in a boring location, the sample will be collected from a depth of 18 to 24 inches below grade or paving. The soil gas results and soil sample results will be compared to determine if additional soil samples should be collected and additional sampling performed where indicated. Soil samples will be collected from any potential source area identified through the soil gas survey. Sample depth and frequency will be dependent on site conditions.

4.2.4 Former Aboveground Oil Tanks

Soil gas samples collected as part of the site-wide soil gas survey will be collected from the locations of the three former aboveground storage tanks. If soil gas samples indicate the presence of contamination in a former tank location, a soil sample for PHAL laboratory analysis will be collected. The sample depths will be based on field screening results (See 4.2.3 above).

4.2.5 Oil Storage Shed

A soil gas sample collected as part of the site-wide soil gas survey will be collected at the discharge point of the pipe from the oil storage shed. A soil sample for PHAL laboratory analysis will be collected. The sample will be collected from a 6 inch interval between 0 to 2 feet below grade based on field screening results.

4.2.6 Scrap Metal Storage Shed

A soil gas sample collected as part of the site-wide soil gas survey will be collected at the scrap metal storage shed area. If soil gas samples indicate the presence of contamination in this area, a soil sample for PHAL laboratory analysis will be collected. The sample depth would be based on field screening results (see 4.2.3 above).

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4.2.7 Storm Drain

A soil gas sample collected as part of the site-wide soil gas survey will be collected at the location of the storm drain catch basin. A soil sample for PHAL laboratory analysis will be collected. **The sample will be collected from a 6 inch interval between 0 to 2 feet below the storm drain invert based on field screening results.**

4.2.8 Pipe

A soil gas sample collected as part of the site-wide soil gas survey will be collected at the location of the pipe through the east wall of Building 13. A soil sample for PHAL laboratory analysis will be collected. **The sample will be collected from a 6 inch interval between 0 to 2 feet below grade based on field screening results.**

4.2.9 Cooling Water Discharge

A soil gas sample collected as part of the site-wide soil gas survey will be collected at the cooling water discharge area east of Building 14. If soil gas samples indicate the presence of contamination in this area, a soil sample for PHAL laboratory analysis will be collected. The sample depth would be based on field screening results (see 4.2.3 above).

4.2.10 Floor Drains

Floor drains are located in the vibratory cleaner area, basement bathroom and hydroform press at south end of Building 13. Soil gas samples collected as part of the site-wide soil gas survey will be collected in the vicinity of the floor drains. **A soil sample for PHAL laboratory analysis will be collected at the basement floor drain. The sample will be collected from a depth of 0-6 inches below the floor drain invert.** If soil gas samples collected in the vicinity of the other floor drains indicate the presence of contamination, a soil sample(s) for PHAL laboratory analysis will be collected. The sample depth would be based on field screening results (see 4.2.3 above).

4.2.11 Dumpster Pad

A soil gas sample collected as part of the site-wide soil gas survey will be collected at the down slope side of the dumpster pad. If soil gas samples indicate the presence of contamination in this area, a soil sample for PHAL laboratory analysis will be collected. The sample depth would be based on field screening results (see 4.2.3 above).

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4.3 Selected Soil Samples for Grain Size Analysis and Organic Carbon Content

Soil samples collected from two depths in two sample locations in the Alleyway area on the Building 12 Property will be submitted for grain size analysis and organic carbon content. Similarly, soil samples, from sample locations to be determined by the results of the soil gas survey on the Building 13 Property, will be submitted for grain size analysis and organic carbon content. Additional samples may be analyzed for these parameters based on observations of subsurface soil conditions. **All of the soil samples collected for laboratory analysis will include analysis for moisture content.** The information obtained will be used in the evaluation of remedial alternatives.

4.4 Sample Matrices and Designations

The matrices to be sampled include soil gas and soil. Each sample location will be identified with a unique designation code.

For soil samples, the designation includes a two digit matrix code (SS), an area of concern code (as provided on Table 3B) and sample location code. If multiple sample depths are collected from the same location, a sample depth code is included. An example is provided:

Sample SSAW-2A = Soil Sample (SS) from Alleyway (AW) location 2 (-2) first sample depth (A)

For soil gas samples, the designation includes a two digit matrix code (SG), an area of concern code and sample grid location code. If a sample is collected from a location off the grid, a letter code is included with the grid location numbers. An example is provided:

Sample SGN-23 = Soil Gas Sample (SG) from North Drum Storage Area (N) at grid location row 2 column 3 (-23)

Field blank and trip blank samples will be designated by an FB or TB respectively followed by the sample collection date. For example a field blank collected on May 6 would be designated "FB-5/6".

Blind duplicates will be submitted to the laboratory with a fictitious sample location code and appropriate matrix and area of concern code.

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5.0 SAMPLING EQUIPMENT AND PROCEDURES

This section discusses the procedures and protocols for soil analysis.

5.1 General Sampling Protocols

The following protocols will be employed during all sampling:

1. All sampling activities will be conducted in accordance with the Health and Safety Plan (HASP).
2. Prior to drilling at the initial and subsequent locations, the drill rig and associated drilling equipment will be cleaned in accordance to the protocols established in Appendix C.
3. All sampling instruments and equipment used in collecting samples for chemical analysis will be cleaned in accordance with the protocols presented in Appendix B.
4. A new pair of disposable latex gloves will be used at each sampling location. Additional glove changes will be undertaken as conditions warrant.
5. All sampling and analysis activities, decontamination activities and the selection, use and calibration of sampling equipment and instruments will follow the protocols and guidelines of the SAP.
6. All sampling and analysis activities also will conform to the New Jersey Technical Regulation for Site Remediation, N.J.A.C. 7:26E.

5.2 Soil Gas Sampling

Soil gas samples will be collected from 1/2 inch holes created by using a manual slide hammer or drive rod. A stainless steel probe is inserted to the full depth of the hole and packed off to isolate the probe's perforations from the atmosphere. A soil gas sample is withdrawn through the probe and captured in a pre-evacuated glass vial. The detailed procedure for collecting the soil gas samples is provided in Appendix A.

Soil gas samples at Building 12 Property will be collected from a depth of 3 feet below grade. This depth is proposed because a majority of the area to be surveyed is covered with asphalt or building structures. This coverage limits the escape of soil vapors to the



atmosphere. Soil gas samples at the Building 13 Property will be collected from a depth of 4 feet. This depth is proposed because a majority of the sample locations are located in unpaved areas.

The number, location and laboratory analysis required for the samples obtained at each location are described in Section 4.1.

The procedures for handling and shipping the samples are provided in Appendix A.

5.3 Soil Boring Sampling

Soil samples for laboratory analysis will be collected using a push sampling device, such as a Geoprobe. **If insufficient sample volume is available from a sample location, an additional adjacent boring will be installed.** In some areas a hole will have to be drilled through concrete or other impervious material to allow for sample collection. Hand driven augers, portable power augers or a jack hammer driven split spoon will be used to collect samples from areas not accessible to larger sampling equipment. Each six-inch interval will be visually examined for the presence of residual staining and screened with a PhotoVac TIP. When a predetermined depth has not been identified for analysis, the interval with obvious staining or with the highest PhotoVac TIP reading will be selected for laboratory analysis. **If all samples in a given boring appear to be the same, the sample for Non-volatile Organics will be collected from the 0 to 6 inch interval below grade or paving. The sample for VOs or PHAL will be collected from a depth of 18 to 24 inches below grade or paving. In areas where two sample depths are proposed, the second sample depth will be collected from the 6 inch interval above ground water.**

During soil boring installation, the types of soils encountered will be recorded in order to prepare a geologic cross-section of the property, evaluate contaminant migration and evaluate remedial alternatives. The detailed procedures for sampling of soil borings are provided in Appendix B. Pre-field cleaning procedures, post-field cleaning procedures and cleaning procedures between borings are provided in Appendix C.

Representative portions of all samples will be retained in appropriate containers for 1) visual classification, 2) field screening and 3) laboratory analysis, where appropriate. The field screening procedures are more thoroughly described in Appendix D. The results will be recorded in field notes. The number, location and laboratory analysis required for the samples obtained at each boring are described in Section 4.1.

The procedures for handling and shipping the samples are provided in Appendix E.



6.0 SAMPLING HANDLING AND ANALYSIS

6.1 Sampling Containers and Preservation

Appropriate sample containers, preservation methods, and laboratory holding times for soil gas, soil and blank water samples are shown in Table 2. **Additional information concerning the NJDEP Methanol field extraction method for VOC and PHAL soil samples is provided in Appendix H.**

The analytical laboratories will supply appropriate sample containers and preservatives (as necessary). The field personnel will be responsible for properly labeling containers and preserving samples (as appropriate). Sample labeling procedures are described in Appendix E.

6.2 Packing, Handling, and Shipping Requirements

Sample custody seals for filled sample containers will also be provided by the analytical laboratories. The filled, labeled, and sealed containers will be placed in a cooler on ice and carefully packed to reduce the possibility of container breakage.

Blanks and all samples must be maintained at 4° C while stored on site and during shipment. **Trip blanks will be shipped to the field within 24 hours of the collection of the field samples they will be evaluated against.** Samples will not be held on site for longer than two calendar days. Samples will be hand delivered to the laboratory by field sampling personnel or retrieved from the Klockner Property or The Whitman Companies, Inc. office by laboratory personnel.

6.3 Documentation

Field personnel will provide comprehensive documentation covering all aspects of field sampling, field analysis, and chain of custody. This documentation constitutes a record which allows reconstruction of all field events to aid in the data review and interpretation process. All documents, records, and information relating to the performance of the field work will be retained in a project file at The Whitman Companies, Inc. office in East Brunswick, New Jersey. Records that will be maintained throughout the field investigation are briefly outlined below.

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6.3.1 Daily Production Documentation

Each field crew will maintain a field notebook consisting of a waterproof, bound notebook which will contain a record of all activities performed at the site. The specific measurements from field testing and sampling will be recorded in the field notebook or on separate documentation forms. At the time of sampling, detailed notes of the sample location will be recorded in the field notebook.

6.3.2 Sampling Information

During soil gas and soil sampling, detailed notes will be made as to the sample location, physical observations, sample depths, and weather conditions (as appropriate). These notes will be recorded in the field notebook. During drilling and soil boring activities, monitoring of ambient air and screening of soil samples for volatile organic compounds will be conducted; these measurements will be recorded in the field notes.

6.3.3 Sample Chain of Custody

Persons will have custody of samples when the samples are in their physical possession, in their view after being in their possession, or in their physical possession and secured so they cannot be tampered with. In addition, when samples are secured in a restricted area accessible to only the authorized personnel, they will be deemed to be in the custody of such authorized personnel.

Chain of custody forms will provide the record of responsibility for sample collection, transport, and submittal to the laboratory. A sample chain of custody form is included in Appendix E. The forms will be filled out at each sampling site, at a group of sampling sites, or at the end of each day of sampling by one of the field personnel designated to be responsible for sample custody. In the event that the samples are relinquished by the designated sampling person to other sampling or field personnel, the chain of custody form will be signed and dated by the appropriate personnel to document the sample transfer. The original chain of custody form will accompany the samples to the laboratory and copies will be forwarded to the Whitman Quality Assurance Coordinator (QAC).

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6.3.4 Field Equipment, Calibration, and Maintenance Logs

To document the calibration and maintenance of field instrumentation, calibration and maintenance logs will be maintained for each piece of field equipment. Calibration procedures and calibration and maintenance logs are provided in Appendix D for the Photovac TIP.

7.0 REFERENCES

ICF Technology, Inc., 1991a. Remedial Investigation Report - Rockaway Borough Well Field Site (Draft Final). USEPA Contract No. 68-W8-0124, July 18, 1991.

ICF Technology, Inc., 1991b. Feasibility Study Report - Rockaway Borough Well Field Site (Draft Final). USEPA Contract No. 68-W8-0124, August 1991.

Science Applications International Corporation, 1986. Draft Final Report - Remedial Investigation and Feasibility Study of Rockaway Borough Well Field Site, June 1986.

United States Environmental Protection Agency, 1995. Administrative Order on Consent, Index No. II-CERCLA-95-104, between Klockner and Klockner and United States Environmental Protection Agency, Effective October 7, 1995.

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**FIELD OPERATIONS PLAN
ROCKAWAY BOROUGH WELL FIELD SITE
OPERABLE UNIT #3
FOR PROPERTY OF
KLOCKNER & KLOCKNER
ROCKAWAY BOROUGH, NEW JERSEY**

PART 2 - QUALITY ASSURANCE PROJECT PLAN

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**FIELD OPERATIONS PLAN
ROCKAWAY BOROUGH WELL FIELD SITE
OPERABLE UNIT #3
FOR PROPERTY OF
KLOCKNER & KLOCKNER
ROCKAWAY BOROUGH, NEW JERSEY**

PART 2 - QUALITY ASSURANCE PROJECT PLAN

1.0 INTRODUCTION

This part of the Field Operations Plan (FOP) provides the Quality Assurance Project Plan (QAPP) for all sampling and analyses activities which are to be undertaken at the Rockaway Borough Well Field Site - Operable Unit #3 at Block 5, Lots 1 and 6 (Building 12 Property), and Block 7, Lots 7 and 8 (Building 13 Property) located in Rockaway, New Jersey. The Building 12 and 13 Properties are collectively referred to as the Klockner Property. The results of the sampling activities are meant to supplement data collected during the previous investigations conducted at the Klockner Property.

This revised FOP incorporates responses to EPA's March 20, 1997 comments concerning the May 1996 Field Operations Plan submitted by The Whitman Companies, Inc. on behalf of Klockner. Changes made in the text of this report are presented in **BOLD** letters.

1.1 Project Objectives

1.1.1 Sampling Objectives

Sampling objectives are outlined in Part 1 - Section 3.0 of the SAP. The sample matrices and analytical testing proposed are summarized in Tables 1A and 1B. Table 2 lists the analytical methods, preservation methods, containers and holding times. Table 3 lists duplicates and field blanks by media and analytical method. Table 4 lists quantitation limits. Quantitation limits for the soil gas analysis are provided in Appendix A.

1.1.2 Data Quality Objectives

Data Quality Objectives (DQOs) are qualitative and quantitative statements that specify the quality of the data required to support decisions made during site-related activities and are based on the end uses of the data to be collected. As such, different data uses may



require different levels of data quality. There are five analytical levels that address various data uses and the QA/QC effort and methods required to achieve the desired level of quality. These levels are:

- Level I - Field Screening: This level is characterized by the use of field instruments and field chemical kits which can provide real-time data to assist in the optimization of sampling point locations and for health and safety support. Level I data can be used in refining sampling plans and determining the extent, presence, or absence of chemical constituents at a site.
- Level II - Field Analysis: Level II field analyses are characterized by the use of portable analytical instruments which can be used on site or in mobile laboratories stationed near a site (close-support labs). Qualitative and quantitative data can be obtained, depending upon the types of contaminants, sample matrix, and personnel skills. Level II data are used to provide "quick turnaround" results for on-going field activities or where initial data will provide information for further investigation.
- Level III - Laboratory Analysis using Methods other than the Contract Laboratory Program (CLP) Routine Analytical Services (RAS): This level involves the use of standard USEPA-approved procedures. Some procedures may be equivalent to CLP RAS containing the same rigorous QA/QC protocols as used in Level IV analyses, but without the CLP requirements for documentation. Some Level III data are used for site characterization, environmental monitoring, confirmation of field data, and to support engineering studies. Level III analyses can be used to provide data for risk assessment requirements.
- Level IV - CLP RAS: This level is characterized by rigorous QA/QC protocols and documentation and provides qualitative and quantitative analytical data. The use of SW-846 methods with CLP requirements for documentation provides a Level IV equivalent data package. Level IV data are typically used for the confirmation of lower level data, risk assessment, and in obtaining highly documented data.
- Level V - Non-Standard Methods: Analyses which may require method modification and/or development. CLP and Special Analytical Services (SAS) are considered Level V. Level V support is used to provide data that cannot be obtained through standard methods. Analysis of samples at this level may involve research, development, and documentation of a new method or the modification of an existing method.

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Level IV data management will be utilized by Whitman for soil samples collected for laboratory analysis. Level IV data has been selected because the assessment data will be utilized for site characterization, confirmation of field data, risk assessment and evaluation and design of remedial alternatives.

A soil gas survey will be conducted to identify potential source areas of previously detected chlorinated organic compounds and will represent analytical Level II. The results obtained will be used to identify locations requiring further investigation through sampling for laboratory analysis by Level IV. Samples for grain size analysis and total organic carbon for use in remedial alternative evaluation will represent analytical level III. Total Organic Vapor Detection using portable field instrumentation will represent analytical Level I.

The DQOs have been determined in accordance with the USEPA guidance documents.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITY

The Whitman Companies, Inc. maintains overall technical responsibility for conducting the RI/FS for the Klockner Property. As such, The Whitman Companies, Inc. will perform the field investigations, tabulate and assess the data, provide QA/QC oversight, and prepare the appropriate reports under the RI/FS.

The direct management of the technical and administrative aspects of the project will be accomplished by representatives of The Whitman Companies, Inc. and the law firm of Riker, Danzig, Scherer, Hyland & Perretti.

To date, the following key personnel have been assigned to this project:

<u>Affiliation</u>	<u>Title</u>	<u>Name</u>	<u>Telephone</u>
The Whitman Companies, Inc.	Officer-in-Charge	Dr. Ira L. Whitman, P.E.	(908) 390-5858
	Project Coordinator/Project Manager	Michael N. Metlitz	
	Field Task Manager/Health & Safety Supervisor	Todd Gerber	
	Quality Assurance Coordinator	Richard Britton	
Riker, Danzig, Scherer, Hyland & Perretti	Legal Counsel	Marilynn R. Greenberg, Esq. & Nancy Eberhardt, Esq.	(201) 538-0800 300575



<u>Affiliation</u>	<u>Title</u>	<u>Name</u>	<u>Telephone</u>
USEPA	Case Manager	Courtney McEnery	(212) 637-4384
	Assistant Regional Counsel	Catherine Garypie, Esq.	(212) 637-3096

Laboratory analytical services will be provided by the following organization:

<u>Affiliation</u>	<u>Title</u>	<u>Name</u>	<u>Telephone</u>
Envirotech Research, Inc.	Laboratory Project Manager	Mark Haulenbeek	(908) 549-3900
	Laboratory Quality Assurance Manager	Mike Urban	

Field analytical services for soil gas surveys will be provided by the following tentatively identified organization:

<u>Affiliation</u>	<u>Title</u>	<u>Name</u>	<u>Telephone</u>
Target Environmental Services, Inc.	Laboratory Project Manager	Brian Abraham, Ph.D.	(410) 992-0347
	Laboratory Quality Assurance Manager	Brian Abraham, Ph.D.	

2.1 The Whitman Companies, Inc.

2.1.1 Officer-in-Charge

The Whitman Officer-in-Charge is directly responsible for activities performed by Whitman associated with the project. The Officer-in-Charge has decision-making authority on behalf of Whitman and is responsible for signing all contracts, reports, and design documents. The Officer-in-Charge will make the final review of the reports associated with the RI/FS prior to client submission and will review all other documents prepared by Whitman. Dr. Ira L. Whitman, P.E. (New Jersey P.E. #) is Whitman's Officer-in-Charge.

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2.1.2 Project Coordinator

Responsibilities and duties of the Project Coordinator include the following:

- Set appropriate project objectives and establish project policy and procedures to address the specific needs of the project as a whole, as well as the objectives of each task;
- Monitor and analyze overall task performance with respect to planned requirements and authorizations;
- Approve reports prior to their final submissions.

Mr. Michael N. Metlitz is Whitman's Project Coordinator.

2.1.3 Project Manager

Responsibilities and duties of the Project Manager include the following:

- Provide overall direction and management of Whitman RI/FS activities as defined in the Work Plan;
- Provide QA management of all aspects of the project within the responsibility of Whitman;
- Assure corrective actions are taken for deficiencies cited during audits of RI/FS activities;
- Provide management of day to day RI/FS activities;
- Develop, establish, and maintain files;
- Perform review of field data reductions and project activity reports;
- Maintain overall QA/QC of the RI/FS;
- Oversee preparation of reports associated with RI/FS.

Mr. Michael N. Metlitz is Whitman's Project Manager.

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2.1.4 Field Task Manager

Responsibilities and duties of the Field Task Manager include the following:

- Manage field staff;
- Direct and participate, if necessary, in field work activities;
- Ensure compliance with all Health and Safety Plan procedures during performance of field work activities;
- Coordinate field and laboratory schedules;
- Review/approve the type of field equipment used and ensure that procedures are followed to achieve the DQOs;
- Review the field instrumentation calibration and maintenance logs to ensure DQOs are met;
- Review field notebooks/logs with respect to completeness, consistency, and accuracy;
- Prepare draft field reports, including a summary of field activities, with an evaluation of internal field audit results.

Mr. Todd Gerber is the Field Task Manager and will also assume the duties of Health and Safety Supervisor (as discussed in the HASP) for this project.

2.1.5 Quality Assurance Coordinator (QAC)

Responsibilities and duties of the QAC include the following:

- Review laboratory data packages;
- Coordinate field QA/QC activities with the Field Task Manager;
- Review field reports;
- Review audit reports;
- Prepare interim QA/QC report;
- Prepare QA/QC report for subsequent incorporation into the RI/FS Report.



Mr. Richard Britton is the Whitman QAC for this project.

2.2 Riker, Danzig, Scherer, Hyland & Perretti

Ms. Marilynn R. Greenberg, Esq. & Ms. Nancy Eberhardt, Esq. are Klockner & Klockner's legal counsel.

2.3 Analytical Laboratory (Envirotech Research, Inc.)

Responsibilities and duties of the analytical laboratory include the following:

- Perform analytical procedures;
- Supply sampling containers and shipping cartons;
- Maintain laboratory custody;
- Strictly adhere to all protocols in the QAPP; contact the Whitman QAC in advance of any protocol deviations.

The analytical laboratory that will perform the analyses for all identified parameters is Envirotech Research, Inc. of Edison, New Jersey. Envirotech Research is a certified laboratory in New Jersey. Their Lab ID No. is 12543.

2.3.1 Laboratory Project Manager

Responsibilities and duties of the Laboratory Project Manager include the following:

- Serve as primary communication link between Whitman and the laboratory technical staff;
- Monitor work loads and ensure availability of resources;
- Oversee preparation of analytical reports;
- Supervise in-house chain of custody;
- Ensure that QAPP protocols are adhered to.

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Mr. Mark Haulenbeek is Envirotech Research's Laboratory Project Manager for the project.

2.3.2 Laboratory Quality Assurance Manager

Responsibilities and duties of the QAM include the following:

- Review and inspect a percentage of project-related laboratory activities (each specific laboratory department reviews and inspects all of its specific activities);
- Conduct audits of laboratory activities;
- Review a percentage of all deliverables prior to submittal to Whitman (each specific department reviews all of its respective data prior to submittal to laboratory's QAM).

Mr. Mike Urban is Envirotech Research's Laboratory QAM for the project.

2.4 Field Laboratory

Responsibilities and duties of the field laboratory include the following:

- Perform analytical procedures;
- Supply sampling containers;
- Maintain laboratory custody;
- Strictly adhere to all protocols in the QAPP; contact the Whitman QAC in advance of any protocol deviations.

The field laboratory that will perform the analyses for volatile organic compounds has been tentatively identified as Target Environmental Services, Inc. of Columbia, Maryland. Target's QAPP and Standard Operating Procedures (SOP) are provided as Appendix A and F respectively.

Target's Laboratory Project Manager and QAM for the project is Brian Abraham, Ph.D. Mr. Abraham's responsibilities and duties are as indicated in Sections 2.3.1 and 2.3.2 above.



2.5 USEPA

The USEPA Case Manager will be responsible for the oversight of the RI/FS and approval of the RI/FS Work Plan including the QAPP. The USEPA Case Manager assigned to the Klockner Property is Ms. Courtney McEnery. The USEPA Assistant Regional Counsel assigned to the Klockner Property is Ms. Katherine Garypie, Esquire.

3.0 QUALITY ASSURANCE OBJECTIVES

The primary QA objective is to develop and implement procedures for defensible sampling, chain of custody, laboratory and field analysis, instrument calibration, data reduction and reporting, internal quality control, audits, preventive maintenance, and corrective action. These procedures are presented or referenced in detail in the following sections of the QAPP.

The goals regarding QA for both field measurements and laboratory analyses are discussed below.

Laboratory duplicates (splits), laboratory blanks, standards, matrix spikes (MS), matrix spike duplicates (MSD), matrix spike blanks (MSB), field duplicates, and rinse blanks will be analyzed to provide the means for assessing data quality from both the laboratory and field. A brief explanation of each QC sample type is provided below:

- Laboratory duplicates will be used to measure analytical precision.
- Laboratory blanks will be used to assess reagent quality, background contamination from analytical instruments, as well as analytical variability.
- Reference standards/materials will be used to assess analytical accuracy.
- For all analyses, matrix spike blank analyses will be included to further assess the accuracy of method performance.
- Field duplicates will be used to assess the overall precision of environmental sampling and laboratory analysis.

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The level of QC effort provided by the laboratory will be equivalent to the level of QC effort specified under the **Level IV DQOs**. Detailed descriptions of the quality control checks for field and analytical data are provided in Section 9.

3.1 Qualitative Quality Assurance Objectives

3.1.1 Representativeness

Representativeness is the degree to which sample data accurately and precisely represent site conditions and is dependent on sampling and analytical variability.

The sample locations were chosen to provide data representative of site conditions. The use of prescribed methods with associated holding times and preservation requirements are intended to provide representative data. Part 1 - Section 4.0 of this document provides details of the sampling proposed at the project site.

3.1.2 Comparability

Comparability is the degree with which one set of data can be compared to another. Comparability throughout the RI/FS will be maintained through consistent sampling and analytical methodologies as set forth in this QAPP, the SAP, and USEPA standard analytical methods.

3.2 Quantitative Quality Assurance Objectives

3.2.1 Completeness

Completeness is defined as a measure of the amount a valid data obtained from an event or investigation compared to the amount that would be expected to be obtained under normal conditions. Completeness of laboratory tests is expected to be 95 percent or better, while overall project completeness is expected to be 90 percent or better.

3.2.2 Precision

Precision is the measure of reproducibility of sample results. Precision will be measured as the degree of mutual agreement of duplicate analyses. The goal is to maintain a level of analytical and measurable precision consistent with the objectives of the project. To maximize precision, consistent sampling and analytical procedures will be followed. All

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RI/FS activities will adhere to established protocols presented in the QAPP and SAP. Specific field and laboratory precision quality control checks are discussed in Section 9.

3.2.3 Accuracy

Accuracy is the degree to which a measured value agrees with the true expected value of a quantity of concern. Reference standards, matrix spikes, blank spikes, and surrogates will be used to assess the accuracy of laboratory data. Specific field and laboratory accuracy quality control checks are discussed in Section 9.

3.2.4 Method Detection Limits

Method detection limits (MDL) and estimated quantitation limits (EQL) are measures of analytical procedure sensitivity for the detection and quantification of analytes, respectively. The MDL is defined as the minimum concentration of a substance that can be measured and reported with 99 percent confidence that the value is above zero. The MDL achieved in a given analysis will vary depending on instrument sensitivity and matrix effects. The calculation of an MDL is addressed in Section 12.

MDLs of field and laboratory measurements will follow method guidelines as discussed in Section 7. Concentrations detected between the MDL and the EQL, when reported, will be listed as estimated values only.

The detection limits for this project are listed in Table 4.

4.0 SITE SELECTION AND SAMPLING PROCEDURES

Site selection and specific sampling procedures are described in Part 1 - Section 4.0 of the SAP. In addition, the Appendices contain the procedures for cleaning equipment; packing, handling, and shipping samples; and obtaining field measurements. A summary of the required sample containers and sampling holding times is provided in Table 2.

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5.0 SAMPLE AND DOCUMENT CUSTODY

Custody procedures will follow those outlined in Test Methods for Evaluation Solid Waste (SW-846) and NEIC Policies and Procedures Manual USEPA-330/9-78DD1-R, revised June 1985. As defined in this document, a sample or file is under your custody if it:

- Is in your possession;
- Is in your view, after being in your possession;
- Was in your possession and you placed it in a secure location;
- Is in a designated secure area.

When samples or files are secured in a restricted area accessible only to authorized personnel, they will be deemed in the custody of such authorized personnel.

5.1 Field Sample Custody

The objective of field custody is to assure that the samples are not tampered with from the time of collection through time of transport to the analytical laboratory. Field custody documentation consists of both field notebooks and field chain of custody forms.

5.1.1 Field Notebooks

Field notebooks will provide the means of recording data collection activities performed. As such, entries will be described in as much detail as possible so that persons returning to the Site can reconstruct a particular situation without the need to rely on memory.

Field notebooks will be permanently bound. Notebooks will be assigned to field personnel, but will be stored in a secure location when not in use. Each notebook will be identified by the project-specific document number. The title page of each notebook will contain the following:

- Person to whom the notebook is assigned;
- Notebook number;
- Project name;
- Project start and end date.

Entries into the notebook will contain a variety of information. At the beginning of each entry, the date, start time, weather, names of all sampling team members present, level



of personal protection being used, and the signature of the person making the entry will be entered. The names of visitors to the Site and the purpose of their visit will also be recorded in the field notebook.

Measurements made and samples collected will be recorded. All entries will be made in ink and no erasures will be made. If an incorrect entry is made, the information will be crossed out with a single strike mark. Whenever a sample is collected, or a measurement is made, a detailed description of the location of the station shall be recorded. The number of photographs taken of the station, if any, will also be noted. All equipment used to make measurements will be identified, along with the date of calibration.

Samples will be collected following the sampling procedures documented in the SAP, Part 1 - Section 5.0. Purchased pre-cleaned, certified sample containers will be supplied by the analytical laboratory. The equipment used to collect samples will be noted, along with the time of sampling, sample description, depth at which the sample was collected, and the volume and number of containers. A sample identification number will be assigned prior to sample collection. Field duplicate samples, which will receive an entirely separate sample identification number, will be noted under sample description.

5.1.2 Field Chain of Custody

Completed chain of custody forms will be required for all samples to be analyzed. Chain of custody forms will be initiated by the sampling crew in the field. The chain of custody forms will contain the sample's unique identification number, sample date and time, sample description, sample type, preservation (if any), and analyses required. The original chain of custody form will accompany the samples to the laboratory. Copies of the chain of custody will be made prior to shipment (or multiple copy forms used) for field documentation. The chain of custody forms will remain with the samples at all times. The samples and signed chain of custody forms will remain in the possession of the sampling crew until the samples are delivered to the express carrier (e.g., Federal Express) or hand delivered to a mobile or permanent laboratory, or placed in secure storage.

Sample labels will be completed for each sample using waterproof ink unless prohibited by weather conditions (for example, a notebook notation would explain that a pencil was used to fill out the sample tag because the ballpoint pen would not function in freezing weather). The labels shall include sample information such as: sample number and location, type of sample, date and time of sampling, sampler's name or initials, preservation method, and analyses to be performed. The completed sample labels will be affixed to each sample container and covered with clear tape.

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Whenever samples are split with a facility or government agency, a separate Sample Receipt will be prepared for those samples and marked to indicate with whom the samples are being split. The person relinquishing the samples to the facility or agency should request the representatives signature acknowledging sample receipt. If the representative is unavailable or refuses to sign, this should be noted in the "Received By" space.

5.1.3 Sample Packing and Shipping

Sample packaging and shipping procedures are designed to ensure that the samples will arrived at the laboratory intact, with the chain of custody.

Samples will be properly packaged for shipment as outlined in Appendix E and dispatched to the appropriate laboratory for analysis, with a separate signed custody record enclosed in each sample box or cooler. Shipping containers will be locked and secured with strapping tape and custody seals for shipment to the laboratory. The preferred procedure includes use of a custody seal attached to the front and back left of the cooler. The custody seals are covered with clear plastic tape. The cooler is strapped shut with strapping tape in at least two locations.

All shipments will be accompanied by the chain of custody form identifying the contents. The original form will accompany the shipment; copies will be retained by the sampler for the sampling office records.

If the samples are sent by common carrier, a bill of lading should be used. Receipts or bills of lading will be retained as part of the permanent project documentation. If sent by mail, the package will be registered with return receipt requested. Commercial carriers are not required to sign off on the custody form as long as the custody forms are sealed inside the sample cooler and the custody seals remain intact.

5.2 Laboratory Custody

The laboratory will adhere to the chain of custody procedures for **Level IV** QC documentation.

5.2.1 Laboratory Sample Receipt

Upon sample receipt, the sample custodian will verify the package seal, open the package, and inspect the contents against the chain of custody. The Whitman QAC will be contacted in the event of any discrepancies between the sample containers and the chain of



custody. The sample custodian will then log the samples in and assign each a unique laboratory sample identification number, which will be placed on each sample bottle. A laboratory internal chain of custody is initiated at this time. Recorded in the laboratory information system will be the project name and code, sampling location, date sampled, date received, analyses required, storage location, and action for final disposal. The samples will then be placed in secure storage.

The laboratory analysts will be alerted to the arrival of samples with the use of a work order. The work order contains all information pertinent to the analysis of the samples.

5.2.2 Laboratory Sample Storage

The analysts will sign and date the internal chain of custody when removing samples from storage. The sample custodian is responsible for filing all chain of custody forms in the project file.

Laboratory personnel will be responsible for the care and custody of the sample once it is transferred to them. Once an analysis is complete, the unused portion of the sample will be returned to the sample custodian who will then sign and date the chain of custody. In the event that the entire sample is depleted during analysis, a notation of "sample depleted" or "entire sample used" is made on the chain of custody.

Samples and sample extracts will be maintained in secure storage until disposal. All samples will be held until notified by the Project Manager.

Samples will be discarded by the laboratory only after authorization is received from the Whitman Project Manager.

All chain of custody and associated paperwork will be maintained in a separate file for the project.

5.2.3 Sample Tracking

Identifying information which describes the sample, procedures performed, and results of the testing will be recorded in a laboratory notebook by the analyst. These notes will be dated and will indicate who performed the analysis, the instrument used, and the instrument conditions.

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Workbooks, bench sheets, instrument logbooks, and instrument printouts are used to trace the history of samples through the analytical process and to document and relate important aspects of the work, including the associated quality controls. All logbooks, bench sheets, instrument logs, and instrument printouts are part of the permanent laboratory record.

Each page, or, as required, each entry is to be dated and initialed by the analyst at the time the record is made. Errors in entry are to be crossed out in indelible ink with a single stroke and corrected without the use of white-out or by obliterating or writing directly over the erroneous entry. All corrections are to be initialed and dated by the individual making the correction. Pages inserted into logbooks are to be stapled to a clean, bound page. The analyst's initials are to be recorded in such a manner that the initials overlap the inserted page and the bound page. A piece of non-removable transparent tape is then to be placed over the initials as a seal. Pages of logbooks that are not completed as part of normal record-keeping procedures should be completed by lining out unused portions.

5.3 Final Evidence Files Custody

The laboratory will establish an evidence file for all pertinent data generated from the analyses performed for the project. This file will include items such as: raw data, chromatograms, and descriptions of sample preparation which will be maintained in a secure location. At the conclusion of the laboratory's involvement with the project, the files will be transferred to Whitman's office in East Brunswick, New Jersey. These files, together with field notebooks and other pertinent information, will be retained for the duration of the project and for a period to be determined as appropriate. This final evidence file will include the following information:

- Project files;
- Analytical data;
- Field records;
- Reports;
- Other associated information (maps, drawings, articles, etc.).

Project files will include all correspondence. Analytical data are to be filed in chronological order. Field records consist of chain of custody forms, field notebooks, photographs, and associated paperwork.

A designated Whitman file custodian will maintain the evidence files in a secure location and will be responsible for adding new materials as necessary. Filed materials may



be removed by project personnel on a temporary basis only. The file custodian will be responsible for refilling materials in a timely manner.

6.0 CALIBRATION PROCEDURES AND FREQUENCY

This section describes procedures for maintaining the accuracy of all the instruments and measuring equipment used for conducting field tests and laboratory analyses. These instruments and equipment should be calibrated prior to use or on a scheduled periodic basis. The field laboratory procedures are included under the laboratory heading.

6.1 Field Instruments/Equipment

Instruments and equipment used to gather, generate, or measure environmental data will be calibrated with sufficient frequency and in such a manner that accuracy and reproducibility of results are consistent with the manufacturer's specifications.

Equipment to be used during the field sampling will be examined to certify that it is in operating condition. This includes checking the manufacturer's operating manual to ensure that all maintenance requirements are being performed. Field notes from previous sampling events will be reviewed to ensure that any prior equipment problems are not overlooked and that any necessary repairs to the equipment have been carried out.

Calibration of field instruments will be performed at the intervals specified by the manufacturer or more frequently as conditions dictate. Field instruments will include a PhotoVac MicroTIP or similar type photionization detector (PID). In the event that any internally calibrated field instrument fails to meet calibration/checkout procedures, it will be returned to the manufacturer for service.

Calibration of field instruments is governed by the specific Standard Operating Procedures for the applicable field analysis method (Appendix D). Such procedures take precedence over the following general discussion where any inconsistency may arise.

6.1.1 PID Calibration

The PID will be calibrated with known gas concentrations daily in the field. The general calibration procedures are included in Appendix D. Specific calibration procedures will follow the instruments procedure manual.

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All calibration information will be recorded in the field notebook. The instrument will be placed on charge at the end of each day.

6.2 Laboratory Instruments

When analyses are conducted according to published USEPA methods, the calibration procedures and frequencies specified in the applicable method will be followed. For soil gas samples, modified USEPA methods will be followed. SOPs for the modified USEPA methods are provided in Appendix F. Records of calibrations will be filed and maintained by the laboratory. These records will be subject to QA audits. For all instruments, the laboratory will maintain trained repair staff with in-house spare parts or will maintain service contracts with vendors.

The analytical procedures used for the sample analyses will be included in the file record.

7.0 ANALYTICAL PROCEDURES

7.1 Field Analysis

The procedures for field measurement of VOCs with a PID are described in Appendix D.

The procedures for field screening will be kept on file at the project site and then maintained in the permanent file record.

7.2 Laboratory Analyses

The soil or any other facility samples collected during the field sampling activities excluding soil gas survey samples will be analyzed by Envirotech Research, Inc., for all identified parameters. The soil gas survey samples collected during the field sampling activities will be analyzed in a mobile laboratory. Target Environmental Services, Inc. has been tentatively identified for this service.

The methods to be utilized by the laboratories are provided in Table 2.

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8.0 DATA REDUCTION, VALIDATION, AND REPORTING

8.1 Field Data Reduction, Validation, and Review

8.1.1 Field Data Reduction

Information which is collected in the field through visual observation, manual measurement, and/or field instrumentation will be recorded in field notebooks, data sheets, and/or forms. Such data will be reviewed by the appropriate Task Manager for adherence to the FOP and consistency of data. Any concerns identified as a result of this review will be discussed with the field personnel, corrected if possible, and as necessary, incorporated into the data evaluation process.

8.1.2 Field Data Validation

Field data calculations, transfers, and interpretations will be conducted by the field personnel and reviewed for accuracy by the appropriate Task Managers and the QAC. Field documentation and data reduction prepared by field personnel will be reviewed by the appropriate Task Manager and QAC. All logs and documents will be checked for:

- General Completeness;
- Readability;
- Usage of appropriate procedures;
- Appropriate instrument calibration and maintenance;
- Reasonableness in comparison to present and past data collected;
- Correct sample locations;
- Correct calculations and interpretations.

8.1.3 Field Data Reporting

Where appropriate, field data forms and calculations will be processed and included in appendices to the appropriate reports prepared as part of the RI/FS. The original field logs, field notebooks, documents, and data reductions will be kept in the project file at the Whitman office in East Brunswick, New Jersey.

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8.2 Laboratory Data Reduction, Validation, and Review

The methods used for validation and review of laboratory data will include EPASs 1988 Draft Functional Guidelines and the current versions of the following EPA Region II standard operating procedures (SOPs) where applicable.

SOP8270B.CHK 54729 04-17-95 USEPA Region 2 SW-846 Method 8270B Data Validation SOP

HW6-REV9.SOP 135296 03-07-95 USEPA Region 2 Organic Data Validation SOP

SOP8080A.CHK 59090 04-27-95 USEPA Region 2 SW-846 Method 8080A

INORGAN.R11 94592 11-18-93 INORGAN.R11 is the USEPA Region II inorganic data validation SOP

HW#6, Revision #8, CLP Organics Data Review and Preliminary Review

HW#2, Revision XI, Evaluation of Metals Data for the Contract Laboratory Program

HW#22, Revision 1.0., Standard Operating Procedure for the Validation of Organic Data Acquired using SW846 Method 8270B, Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS): Capillary Column Technique

Note SOPs HW2 and HW6 are written for the CLP contracts but contain similar analytical techniques to the SW-846 methods proposed for this investigation. EPA currently does not have SOPs for analysis of VOA and metals via SW-846 methods. Therefore, Klockner will use the volatile organic portion of HW#2, and HW#6 as guidance for qualifying volatile and metals data, respectively and use HW#22 to validate and qualify semivolatile organic data.

8.2.1 Laboratory Data Reduction

The calculations used for data reduction are specified in each of the analysis methods referenced previously. Whenever possible, analytical data is transferred directly from the instrument to a computerized data system. Raw data is entered into permanently bound laboratory notebooks. The data entered are sufficient to document all factors used to arrive at the reported value.

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Concentration calculations for chromatographic analyses are based on response factors. Concentration calculations for soil gas survey chromatographic analysis are based on calibration factors. Quantitation is performed using either internal or external standards.

Non-chromatographic analyses are generally based on regression analysis. Regression analysis is used to fit a curve through the calibration standard data. The samples concentrations are calculated using the resulting regression equations.

Standard data are fitted to an equation in the form:

$$y = a + bx$$

where

y = instrument response

x = concentration of amount of analyte

a = y-intercept

b = slope of the line (sensitivity)

After the regression equation has been computed, the sample concentration (x) can be calculated by rearranging the regression equation to read:

$$x = (y-a) / b$$

Unless otherwise specified, all values are reported uncorrected for blank contamination.

8.2.2 Laboratory Data Validation

Raw data is examined to assess compliance with quality control guidelines. Surrogate, matrix spike, and quality control check sample recoveries are checked. Samples are checked for possible contamination or interferences. Concentrations are checked to insure the systems are not saturated. Dilutions are performed as necessary. Any deviations from the guidelines call for corrective action. Those deviations which are determined to be caused by factors outside the laboratory's control, such as matrix interference, are noted with an explanation in the report narrative. Calculations are checked and the report reviewed for errors and oversights. All reports are validated by the Laboratory QAM prior to release.

Once a report section is assembled, it is reviewed for any discrepancies, errors or omissions. A preliminary narrative is produced at this time outlining quality control



compliance and details specific to the analysis of the samples. The individual sections are assembled into a complete data package. Added to the packages at this time are the Laboratory Analytical Request Forms, the chain of custody, air bills, and other control forms. The packages are then given to the QAM for review.

The QAM reviews the package, see that any necessary corrections are made, creates a report narrative, and gives the package to the **Laboratory Project Manager** who reviews it for completeness and compliance.

Data packages include, at a minimum, the following items:

Narrative

The narrative serves as a summary of activities which took place during the course of sample analysis. Information in the narrative includes:

- Laboratory name and address;
- Date of sample receipt;
- Cross reference of laboratory identification number to contractor sample identification;
- Analytical methods used;
- Deviations from specified protocol;
- Corrective actions taken.

Included with the narrative are any sample handling documents including field and internal chain of custodies, air bills and shipping tags.

Analytical Results

The analytical results reported are specific to analysis type. The following information is included, as applicable:

- Sample target compound/analyte results;
- Surrogate spike recoveries;
- Matrix spike/matrix spike duplicate/matrix spike blank recoveries;
- QC check sample recoveries;
- Duplicate sample results (inorganic and conventional chemistries);
- Blank target compound/analyte results.

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All sample results on the report forms are corrected for dilutions. Unless otherwise specified all results are reported uncorrected for blank contamination.

Supporting Documentation

Reports include all raw data required to recalculate any result including instrument printouts, chromatograms, and quantitation reports. Also include are all standards used in calibration and calculation of analytical results.

Sample extraction, digestion and other preparation logs, standard preparation logs, instrument run logs, and moisture content calculations are also included in the report.

Correspondence

Included in this section is all written correspondence.

8.3 Data Evaluation

Upon receipt at Whitman, the data packages for CLP and non-CLP parameters will be evaluated by **Whitman's QAC** as follows:

- Evaluate completeness of data.
- Verify that field chain of custody forms were completed and that samples were logged properly.
- Review QA/QC data (i.e., make sure duplicates, blanks, and spikes were analyzed on the minimum number of samples as specified in the QAPP; verify that duplicate and matrix spike recoveries are acceptable).
- Investigate anomalies identified during review. In such an event, anomalies will be discussed with the Project Managers or Laboratory Manager, and internal QA/QC data will be reviewed as appropriate.
- Verify that holding times were met for each parameter. Holding time exceedances, should they occur, will be documented. Data for all samples exceeding holding time requirements will be flagged as either estimated or rejected. The decision as to which qualifier is more appropriate will be made on a case by case basis.

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- Verify that parameters were analyzed by the methods identified in the QAPP.
- If data appear suspect, the specific data of concern will be investigated. Calculations will be traced back to the raw data; if the calculations do not agree with the prescribed limits, the cause will be determined and corrected.

Deficiencies discovered as a result of data validation, as well as the corrective actions to be implemented in response, will be documented and submitted to the Project Manager.

9.0 INTERNAL QUALITY CONTROL CHECKS

9.1 Field Sample Collection

The assessment of field sampling precision and accuracy will be made through the collection of field duplicates, field blanks **and trip blanks**, in accordance with the applicable procedures described in the SAP.

9.2 Field Management

QC procedures for PID measurements include checks on reproducibility of the measurement by obtaining multiple readings on a single sample or standard, and by calibrating the instruments.

Laboratory internal control checks will include analyses of matrix spikes (and matrix spike duplicates), laboratory duplicates (split samples), laboratory blanks, internal standards, quality control samples, surrogates, and calibration standards. Laboratory control charts will be used to determine long-term instrument trends.

Checks for analytical precision will include the calculation of relative percent difference (RPD) from the analysis of laboratory duplicate (split) samples and matrix spike duplicates.

Analytical accuracy will be monitored in the laboratory through the use of reference standards and matrix spikes. Matrix spikes will measure the recovery of a known concentration, and the percent recovery will be calculated. Accuracy limits will be in accordance with USEPA analytical method protocols.

As outlined in the CLP-SOW (USEPA, OLM3.2; USEPA, ILMO4.0) guidelines, the QC samples will include matrix spikes and matrix spike duplicates for all analyses. QC samples



for inorganic analytes will include laboratory duplicates and matrix spike samples. QC samples for soil gas analysis will include duplicates (see Appendices A and F).

9.2.1 Laboratory Duplicates

To account for analytical variability, samples will be split in the laboratory and considered laboratory duplicates. The reproducibility (RPD) limit is 30 percent.

9.2.2 Laboratory Blanks

Laboratory blanks will be used to measure solvent or reagent quality, glassware cleaning effectiveness, and instrument background. Laboratory blanks will be prepared at a frequency consistent with CLP guidelines (USEPA, OLMO3.2; USEPA, ILMO4.0).

9.2.3 Method Blanks

Sources of contamination in the analytical process, whether a contribution of specific analytes or a source of interferences, need to be identified, isolate, and corrected. The intent of the method blank is to identify possible sources of contamination within the analytical process. For this reason, it is necessary that the method blank be initiated at the beginning of the process and encompass all aspects of the analytical work. These blanks will be used for glassware, reagents, instrumentation, or other potential sources of contamination affecting sample analysis. In the absence of a specified frequency, a method blank is analyzed with each analytical series at a frequency of one method blank associated with no more than 20 samples.

9.2.4 Clean Bottle/Container Certification

Sample bottles will be supplied by the laboratory as certified-clean (I-Chem 300 series containers or equivalent). Certificates of analysis will be stored in the final evidence file.

9.2.5 Matrix Spikes/Matrix Spike Duplicates

Matrix spike and matrix spike duplicate analyses for each medium to be analyzed except soil gas will be performed. Recoveries for matrix spike/matrix spike duplicate analyses will be expected to be within acceptable ranges as defined by the specific analytic method.

Matrix spike data will be examined in conjunction with other indicators of accuracy such as surrogate spike data to assess the accuracy of the analytical method. Long-term, matrix



spike recoveries will be examined for an indication of overall method performance. Results outside of the specified range will require review and, if determined necessary, re-extraction and reanalyses.

9.2.6 Surrogate Spikes

Surrogates are compounds that are unlikely to be found in nature and that have properties similar to the analytes of interest. This type of control is primarily used in the GC/MS and GC laboratories.

The intent of a surrogate spike is to provide insight into the efficiency of an analytical method on a sample-specific basis. This control reflects analytical conditions which may or may not be attributable to sample matrix. If results of surrogate spike analysis exceed specified tolerances, then the analytical results need to be evaluated thoroughly in conjunction with other control measures. In the absence of other control measures, the integrity of the data cannot be verified. Reanalysis of the sample with additional controls may be necessary to assess the source of deviation.

9.2.7 Internal Standards

Internal standard areas are monitored in the GC/MS laboratory. The area response of each internal standard is monitored. The tolerance ranges of these standards are specified in the CLP-SOW (USEPA, OLMO3.2).

In the absence of any other criteria, the following applies: the area of any internal standard cannot fall below 50 percent of its corresponding value in the preceding calibration check standard, nor can it rise above 100 percent of its value. If internal standard areas in one or more samples exceed the specified tolerances, then the instrument is recalibrated and all affected samples reanalyzed.

9.2.8 Quality Control Check Samples

Analytical methods described in Section 7.0 will be utilized for guidance on the use of QC check samples.

9.2.9 Calibration Standards

Analytical methods described in Section 7.0 will be utilized for guidance on the use of laboratory instrument calibration standards.

300598



An initial calibration will be run following method specified guidelines. Continuing calibration check standards will be run throughout the analytical sequence at a frequency specified by the method.

9.2.10 Reference Standards

Reference standards are standards of known concentration that are prepared from a source independent of the calibration standards. These reference standards are generally available through the USEPA and the National Bureau of Standards, or are specified by analytical methodologies. Reference standards are included in the analytical process as specified in the appropriate analytical method. The intent of reference standard analysis is to provide insight into the proficiency demonstrated within an analytical series. This includes the preparation of calibration standards, the validity of calibration, sample preparation, instrument set-up, and the premises inherent in quantitation. Results of a reference standard analysis which exceed specified tolerances require reanalysis of all associated samples. The representativeness of the standard analysis in relation to the individually analyzed samples must be considered in evaluating the results.

9.3 Quality Assurance Program

This production of analytical data of known and documented usable quality is further ensured through the use of a quality assurance program and quality control checks.

The laboratory has a written QA/QC program, which provides rules and guidelines to ensure the reliability and validity of work conducted at the laboratory. A copy of the Quality Assurance Manual is included as Volume 2 of this submittal. Compliance with the QA/QC program is coordinated and monitored by the laboratory Quality Assurance Manager (QAM).

The stated objectives of the laboratory QA/QC Program are to:

- Ensure that all procedures are documented, including any changes in administrative and/or technical procedures.
- Ensure that all analytical procedures are conducted according to sound scientific principles and have been validated.
- Monitor the performance of the laboratory by a systematic inspection program and provide for corrective actions as necessary.

300599



- Collaborate with other laboratories in establishing quality levels, as appropriate.
- Ensure that all data are properly recorded and archived.

All laboratory procedures are documented in writing as Standard Operating Procedures that are edited and controlled by the QAM. Internal quality control procedures for analytical services will be conducted by the laboratory in accordance with their SOPs and the individual method requirements.

The quality assurance program includes the specification of quality control checks. These specifications include the types of audits required (sample spikes, surrogate spikes, reference samples, controls, blanks), the frequency of each audit, the compounds to be used for sample spikes and surrogate spikes, and the quality control acceptance criteria for these audits.

The laboratory will document, in each data package provided, that both initial and ongoing instrument and analytical QC functions have been met. Any samples analyzed in non-conformance with the QC criteria will be reanalyzed by the laboratory, if sufficient sample volume is available (original and/or extracted).

10.0 PERFORMANCE AND SYSTEM AUDITS

Performance and system audits of both field and laboratory activities will be conducted to verify that sampling and analysis are performed in accordance with the procedures established in the SAP and QAPP.

10.1 Field Audits

Internal audits of field activities (sampling and measurements) will be conducted by the Whitman QAC and/or Field Task Manager. The audits will include examination of field sampling records, field instrument operating records, sample collection, handling and packaging in compliance with the established procedures, maintenance of QA procedures, chain of custody, etc. These audits will occur at the onset of the project to verify that all established procedures are followed. Follow-up audits will be conducted to correct deficiencies and to verify that QA procedures are maintained throughout the work. The audits will involve review of field measurement records, instrumentation calibration records, and sample documentation.

300600



10.2 Laboratory Audits

10.2.1 Internal Performance Audits

The laboratory QAM will evaluate laboratory precision and accuracy through comparison of results of duplicate samples and analyses, and through review of QC samples, spikes, and blanks.

10.2.2 External Performance Audits

Whitman may conduct performance audits by sending "double blind" performance evaluation (PE) samples (e.g., samples which are not discernable from routine field samples) to the analytical laboratory. The PE samples will consist of water containing a known amount of analyte of interest. **USEPA will be provided with a copy of any performance evaluation (PE) results.**

10.2.3 Internal System Audits

Internal system audits are conducted by the Laboratory QAM. The audit is a qualitative evaluation of all components of the laboratory quality control measurement system. The audit is a qualitative evaluation of all components of the laboratory quality control measurement system. The audit serves to determine if all measurement systems are being used appropriately:

The system audits are conducted to evaluate the following:

- Sample handling procedures;
- Calibration procedures;
- Analytical procedures;
- QC results;
- Safety procedures;
- Record keeping procedures;
- Timeliness of analysis and reporting.

10.2.4 External System Audits

As participants in various state and federal programs, laboratories are subject to audits by the associated regulatory agencies. The focus of these audits is to assess general laboratory practices and conformance to specific program protocol.



Whitman reserves the right to conduct an on-site audit of the laboratory prior to the start of analyses for this project. Additional audits may be performed during the course of the project as deemed necessary.

11.0 PREVENTATIVE MAINTENANCE

11.1 Field Instruments and Equipment

Prior to any field sampling, each piece of field equipment will be inspected to assure that it is operational. If the equipment is not operational, it will be serviced prior to use. All meters which require charging or batteries will be fully charged or have fresh batteries. If instrument servicing is required, it is the responsibility of the appropriate Task Manager to follow the maintenance schedule and arrange for prompt service.

A logbook is maintained for all field equipment. The logbook contains records of operation, maintenance, and calibration.

Field equipment returned from the site will be inspected to confirm that it is in working order. This inspection is recorded in the logbook. It is the obligation of the last user to record any equipment problems in the logbook.

Non-operational field equipment will be either repaired or replaced. Appropriate spare parts will be maintained for field meters. Details regarding field equipment maintenance, operation, and calibration are provided in Appendix D.

11.2 Laboratory Instruments and Equipment

All instruments and equipment are serviced only by qualified personnel. All repairs, adjustments, and calibrations are documented in the appropriate logbook or data sheet. All instruments have regularly updated maintenance logs.

11.3 Instrument Maintenance

Preventative maintenance of laboratory equipment will follow guidelines recommended by the manufacturer. A malfunctioning instrument will be repaired by in-house staff or through a service call by the manufacturer as appropriate.

300602



It is laboratory policy to maintain a sufficient supply of spare parts for all its instruments to minimize downtime. Whenever possible, backup instrumentation is retained.

Whenever practical, analytical equipment are maintained under service contracts. The contracts allow for preventative maintenance for all systems as well as system repair on an "as needed" basis. The laboratory has sufficient trained staff to allow for routine day to day maintenance on all equipment.

11.4 Equipment Monitoring

On a daily basis, the operation of balances, ovens, refrigerators, and water purification systems are checked and documented. Any discrepancies are immediately reported to the appropriate laboratory personnel for resolution.

12.0 CALCULATION OF DATA QUALITY INDICATORS

12.1 Field Measurements

Field data will be assessed by the Field Task Manager and QAC. The field results will be reviewed for compliance with the established QC criteria that are specified in the QAPP. Accuracy of the field measurements will be assessed using daily instrument calibration, calibration check, and analysis of blanks.

12.2 Laboratory Data

Laboratory results will be assessed by the QAC for compliance with required precision, accuracy, completeness and sensitivity as presented below.

- Precision: Precision of laboratory analysis will be assessed by comparing the analytical results between matrix spike/matrix spike duplicate (MS/MSD) for organic analysis, and laboratory duplicate analyses for inorganic and conventional chemistries analyses. Precision of field measures will be assessed using field duplicates. The relative percent difference (%RPD) will be calculated for each pair of duplicate analysis using the equation below:

300603



$$\%RPD = \frac{S-D}{(S+D)/2} \times 100$$

Where:

S = First sample value (initial or MS value)

D = Second sample value (duplicate or MSD value)

- Accuracy: Accuracy of laboratory results will be assessed for compliance with the established QA criteria that are described in this QAPP using the analytical results of matrix spike/matrix spike duplicate samples, surrogates, and blanks. The percent recovery (%R) of matrix spike samples will be calculated using the equation below.

$$\%R = \frac{A-B}{C} \times 100$$

Where:

A = The analyte concentration determined experimentally from the spiked sample.

B = The background level determined by a separate analysis of the unspiked sample.

C = The amount of the spike added.

- Completeness: The completeness of analytical results will be assessed for compliance with the amount a data required for decision making. The completeness is calculated using the equation below.

$$Completeness = \frac{Valid\ Data\ Obtained}{Total\ Data\ Planned} \times 100$$

- Sensitivity: The achievement of method detection limits (MDLs) depends on instrument sensitivity and matrix effects. Therefore, it is important to monitor the instrument sensitivity to ensure good data quality through constant checks on instrument performance. The method detection limit is defined as the minimum concentration of a substance that can be measured with 99 percent confidence that the concentration is above zero. The MDL is calculated as follows:

300604



$$MDL = t_{(n-1, 1-\alpha = 0.99)} \times S$$

Where:

s = standard deviation of replicate analyses

$t_{(n-1, 1-\alpha = 0.99)}$ = a student's t-value for a one-sided 99% confidence level and a standard deviation estimate with n-1 degrees of freedom.

13.0 CORRECTIVE ACTIONS

Corrective actions may be required for two classes of problems: analytical and equipment problems, and noncompliance problems. Analytical and equipment problems may occur during sampling and sample handling, sample preparation, laboratory instrumental analysis, and may be evidenced during data review.

For non-compliance problems, a corrective action program will be established and implemented at the time the problem is identified. The person who identified the problem is responsible for notifying the proper project member. If the problem is analytical in nature, information on these problems will be communicated to the Laboratory QAM and Whitman QAC, who will in turn direct the information to the proper project member. Implementation of corrective action will be confirmed through the same channels.

Any non-conformance with the established quality control procedures in the QAPP or SAP will be identified and corrected in accordance with the QAPP.

Corrective actions will be implemented and documented in the field notebook. No staff member will initiate corrective action without prior communication of findings through the proper channels.

13.1 Sample Collection/Field Measurements

Technical staff and project personnel will be responsible for reporting suspected technical or QA non-conformances, or suspected deficiencies to the Field Manager. The Field Task Manager will be responsible for assessing the suspected problems in consultation with the QAC. A decision will be made based on the potential for the situation to impact the quality of the data. If it is determined that the situation warrants a reportable non-



conformance requiring corrective action, then a non-conformance report will be initiated by the Field Manager.

The Field Manager will be responsible for ensuring that corrective action for non-conformances are initiated by:

- Evaluating all reported non-conformances;
- Controlling additional work on non-conforming items;
- Determining disposition or action to be taken;
- Maintaining a log of non-conformances;
- Reviewing non-conformance reports and corrective actions taken;
- Ensuring that non-conformance reports are included in the final site documentation in project files.

If appropriate, the Field Manager will ensure that no additional work that is dependent on the nonconforming activity is performed until the corrective actions are completed. Corrective action for field measurements may include the following:

- Repeat the measurement to check the error
- Check for all proper adjustments for ambient conditions such as temperature
- Check the batteries
- Recalibrate
- Replace the instrument or measured devices
- Stop work (if necessary)

The Whitman Project Manager is responsible for overseeing all site activities. In this role, the Project Manager at time is required to adjust the site programs to accommodate site-specific needs. When it becomes necessary to modify a program, the Project Manager is notified of the anticipated change and implements the necessary changes after obtaining the approval of Riker, Danzig, Scherer, Hyland & Perretti and USEPA. The change in the program will be documented. Riker, Danzig, Scherer, Hyland & Perretti and USEPA must approve the change prior to field implementation, if feasible. If unacceptable, the action taken during the period of deviation will be evaluated to determine the significance of any departure from established program practices and appropriate action taken.

The Whitman Project Manager is responsible for controlling, tracking, and implementing the identified changes. Reports on all changes will be distributed to all affected parties. Riker, Danzig, Scherer, Hyland & Perretti and USEPA will be notified whenever program changes in the field are made.

300606



13.2 Laboratory Analysis

Corrective actions are required whenever an out-of-control event or potential out-of-control event is noted. The investigative action taken is somewhat dependent on the analysis and the event. Laboratory personnel are alerted that corrective actions may be necessary if:

- QC data are outside the warning or acceptable windows for precision and accuracy;
- Blanks contain target analytes above acceptable levels;
- Undesirable trends are detected in spike recoveries or RPD between duplicates;
- There are unusual changes in detection limits;
- Deficiencies are detected by the QA Department during internal or external audits or from the results of performance evaluation samples;
- Inquiries concerning data quality are received.

Corrective action procedures are often handled at the bench level by the analyst, who reviews the preparation or extraction procedure for possible errors, checks the instrument calibration, spike and calibration mixes, instrument sensitivity, etc. If the problem persists or cannot be identified, the matter is referred to the laboratory supervisor, manager, and/or QA department for further investigation. Once resolved, full documentation of the corrective action procedure is filed with the QA department. Corrective action may include:

- Reanalyzing the samples, if holding time criteria permits;
- Resampling and analyzing;
- Evaluation and amending sampling procedures;
- Evaluating and amending analytical procedures;
- Accepting data and acknowledging the level of uncertainty.

14.0 QUALITY ASSURANCE REPORTS TO MANAGEMENT

The RI/FS Reports will contain QA section that summarize data quality information collected during the project. Items which may be included in the reports are as follows:

- Changes in QAPP;
- Summary of QA/QC programs;
- Results of system and performance audits;
- Significant QA/QC problems, recommended solutions, and results of corrective actions;



- Data quality assessment;
- Evaluation of compliance with data quality objectives and the resulting impact on decision making;
- Limitations on the use of data.

As data becomes available, it will be provided in the monthly progress reports to USEPA.

15.0 REFERENCES

United States Environmental Protection Agency, Contract Laboratory Program Statement of Work for Organic Analysis. Document Number OLMO3.2.

United States Environmental Protection Agency, Contract Laboratory Program Statement of Work for Inorganic Analysis. Document Number ILMO4.0.

300608



TABLES

- 1A. Summary of Proposed Soil Gas Samples
- 1B. Summary of Proposed Soil Samples
- 2. Summary of Preservation Methods, Sample Containers, Holding Times and Analytical Methods
- 3. Summary of Sampling Duplicates and Field Blanks
- 4. Practical Quantitation Limits

300610



TABLE 1A
KLOCKNER PROPERTY
SUMMARY OF PROPOSED SOIL GAS SAMPLES

<u>Area</u>	<u>Soil Gas Sample Designation</u>	<u>Analytical Parameters</u>
Alleyway Area Building 12	SGA-04A	PHAL
	SGA-13	PHAL
	SGA-14	PHAL
	SGA-14A	PHAL
	SGA-15	PHAL
	SGA-21	PHAL
	SGA-22	PHAL
	SGA-23	PHAL
	SGA-24	PHAL
	SGA-25	PHAL
	SGA-3A1	PHAL
	SGA-3A2	PHAL
	SGA-33	PHAL
	SGA-34	PHAL
	SGA-35	PHAL
	SGA-36	PHAL
	SGA-43	PHAL
	SGA-44	PHAL
	SGA-45	PHAL
	SGA-4A6	PHAL
	SGA-51	PHAL
	SGA-52	PHAL
	SGA-53	PHAL
	SGA-54	PHAL
	SGA-55	PHAL
	SGA-63	PHAL
	SGA-64	PHAL
	SGA-65	PHAL

300611



TABLE 1A (Continued)

**KLOCKNER PROPERTY
SUMMARY OF PROPOSED SOIL GAS SAMPLES**

<u>Area</u>	<u>Soil Gas Sample Designation</u>	<u>Analytical Parameters</u>
North Drum Storage Area - Building 12	SGN-11	VOC
	SGN-12	VOC
	SGN-13	VOC
	SGN-20	VOC
	SGN-21	VOC
	SGN-22	VOC
	SGN-23	VOC
	SGN-31	VOC
	SGN-32	VOC
	SGN-33	VOC
	SGN-42	VOC
	SGN-43	VOC
Soil Gas Survey - Building 13	SG-00A	PHAL
	SG-01A	PHAL
	SG-10	PHAL
	SG-11	PHAL
	SG-12	PHAL
	SG-12A	PHAL
	SG-13	PHAL
	SG-14	PHAL
	SG-15	PHAL
	SG-20	PHAL
	SG-20A	PHAL
	SG-21	PHAL
	SG-22A	PHAL
	SG-23	PHAL
	SG-24	PHAL
	SG-25	PHAL
	SG-30	PHAL
	SG-31	PHAL
	SG-32A	PHAL
	SG-32B	PHAL
	SG-33	PHAL
	SG-34	PHAL



TABLE 1A (Continued)

**KLOCKNER PROPERTY
SUMMARY OF PROPOSED SOIL GAS SAMPLES**

<u>Area</u>	<u>Soil Gas Sample Designation</u>	<u>Analytical Parameters</u>
	SG-35	PHAL
	SG-40	PHAL
	SG-41	PHAL
	SG-42	PHAL
	SG-42A	PHAL
	SG-42B	PHAL
	SG-43	PHAL
	SG-44	PHAL
	SG-45	PHAL
	SG-46	PHAL
	SG-50	PHAL
	SG-50A	PHAL
	SG-51	PHAL
	SG-52	PHAL

PHAL - Purgeable halocarbons by EPA Method 8010

VOC - Volatile organic compounds by EPA Methods 8010 and 8020

NOTE 1: Sample locations identified by grid row and column numbers

NOTE 2: Samples will be analyzed in mobile laboratory

NOTE 3: Building 12 samples will be collected from depth of 3 feet and Building 13 at 4 feet

NOTE 4: Additional soil gas samples will be collected at the Building 13 Property from two depths in any potential source areas identified by the first phase of soil gas samples

300613



TABLE 1B
KLOCKNER PROPERTY
SUMMARY OF PROPOSED SOIL SAMPLING

<u>AEC</u>	<u>Sample Designation</u>	<u>Sample Depth</u>	<u>Analytical Parameters</u>
<u>Building 12</u>			
Underground Gasoline Tank	SSGT-1	0-6" Below Tank Backfill	VOC, Lead
	SSGT-2	0-6" Below Tank Backfill	VOC
Waste Oil Tank	SSWT-1	7-7.5'	PHAL, TAL
	SSWT-2	7-7.5'	PHAL
Catch Basin/Storm Sewer	SSCB-1	2-2.5'	BN, TAL
Leaching Pit	SSLP-1	12-12.5'	TAL
Degreaser Pit	SSDP-1	2.5-3'	PHAL, TAL
Alleyway ¹	SSAW-1 ²	-	PHAL
	SSAW-2 ²	-	PHAL
	SSAW-3 ²	-	PHAL
	SSAW-4 ²	-	PHAL
	SSAW-5 ²	-	PHAL
	SSAW-6 ²	-	PHAL
	SSAW-7 ²	-	PHAL
Scale Room	SSSR-1	Field Determined	PHAL
	SSSR-2	0-6" below floor	PHAL
	SSSR-3	0-6" below floor	PHAL
Drum Storage Shed	SSFS-1A	0-6" below pavement	PHC, BN*, TAL, VOC
	SSFS-1B	Field Determined	VOC
Drum Storage in Alleyway	SSDSA-1	0-6" below pavement	TAL, CN
North Drum Storage Area	SSNDS-1A	0-6" below pavement	PHC, BN*, TAL, VOC
	SSNDS-1B	Field Determined	VOC
	SSNDS-2A	0-6" below pavement	PHC, BN*, TAL, VOC
	SSNDS-2B	Field Determined	VOC
Sump	SSSP-1	1-1.5' below sump invert	PHC, VOC, BN*, TAL

300614



TABLE 1B (Continued)

**KLOCKNER PROPERTY
SUMMARY OF PROPOSED SOIL SAMPLING**

<u>AEC</u>	<u>Sample Designation</u>	<u>Sample Depth</u>	<u>Analytical Parameters</u>
<u>Building 12</u>			
Geologic Characterization	SSGC-1	Field Determined	GS, TOC
	SSGC-2	Field Determined	GS, TOC
	SSGC-3	Field Determined	GS, TOC
	SSGC-4	Field Determined	GS, TOC
<u>Building 13</u>			
Oil Storage Shed	SSOSS-1	Field Determined	PHAL
Storm Drain	SSSD-1	Field Determined	PHAL
Pipe	SSPP-1	Field Determined	PHAL
Basement Floor Drain	SSFD-1	Field Determined	PHAL
Geological Characterization	SSGC-?	Field Determined	GS, TOC

KEY

- PHC - Petroleum Hydrocarbons by EPA Method 418.1 modified for soil
- VOC - GC/MS Target compound list Volatile Organic Compounds +10 by EPA Method SW-846 8240
- BN - GC/MS Target compound list Base/Neutral Extractable Organic Compounds +15 by EPA Method SW-846 8270
- TAL - Total analyte list metals (including lead) by EPA Methods SW-846 6010 and SW-846 7000 (Mercury by SW846 7471A)
- CN - Cyanide by CLP SOW Methodology for Inorganic Analysis
- PHAL - GC Purgeable Halocarbons by EPA Method SW-846 8010
- GS - Grain size by ASTM D-422
- TOC - Total Organic Carbon by USEPA Region II Lloyd Kahn Method
- * - Contingent on PHC results
- 1 - This area includes the Quonset Hut and area between the Alleyway and Degreaser Pit
- 2 - The actual number of boring locations and samples collected from each boring location will be based on the results of the proposed soil gas survey
- - Sample depths will be field determined, see ²
- ? - Number of samples to be determined by results of soil gas survey



TABLE 2

**KLOCKNER PROPERTY
SUMMARY OF PRESERVATION METHODS, SAMPLE CONTAINERS,
HOLDING TIMES AND ANALYTICAL METHODS**

<u>Parameter</u>	<u>Sample Container</u>	<u>Sample Volume</u>	<u>Preservation</u>	<u>Maximum Holding Time*</u>	<u>Analytical Methodology</u>
A. Soil Sample Analysis					
GC Purgeable Halocarbons	2-40 ml volatile organic analysis glass vial	10g	25 ml methanol 4 °C	14 days	SW-846, 3rd edition, vol. 1-B; GC-8010
TCL Volatile Organic Compounds +10 with Xylenes	4 oz. volatile organic analysis glass container	10g	25 ml methanol 4 °C	14 days	SW-846, 3rd edition, vol. 1-B; GC/MS-8240
TCL Base/Neutral Extractable Organics +10	8 oz. glass container	30g	4 °C	Extraction: 14 days Analysis: 40 days from extraction	SW-846, 3rd edition, vol. 1-B; GC/MS-8270
TAL Metals (except Mercury)	8 oz. glass container	5g	4 °C	6 months	SW-846, 3rd edition, vol. 1-A; 6010 & 7000
Mercury	8 oz. glass container	1g	4 °C	28 days	SW-846, 3rd edition, vol. 1-A; 7471A
Total Cyanide	8 oz. glass container	30g	4 °C	14 days	CLP SOW Methodology, for Inorganic Analysis Multi-Media, Multi-Concentration, Document ILM04.0
Petroleum Hydrocarbons	8 oz. glass container	30g	4 °C	Extraction: 28 days Analysis: 40 days from extraction	EPA Method 418.1 modified for soil with soxhlet extraction
Grain Size	8 oz glass container	500g	-	-	ASTM D-422
Total Organic Carbon	8 oz. glass container	25g	4 °C	14 days	USEPA Region 2 Lloyd Kahn Method for determination of Total Organic Carbon in Sediment, July 1988
B. Soil Gas Analysis					
GC Volatile Organics	Pre-evacuated 30 ml glass vial	30 ml @ 2 atm	-	5 days	SW-846 3rd edition, vol. 1-B; modified 8010 & 8020

300616



TABLE 2 (Continued)

**KLOCKNER PROPERTY
SUMMARY OF PRESERVATION METHODS, SAMPLE CONTAINERS,
HOLDING TIMES AND ANALYTICAL METHODS**

<u>Parameter</u>	<u>Sample Container</u>	<u>Sample Volume</u>	<u>Preservation</u>	<u>Maximum Holding Time*</u>	<u>Analytical Methodology</u>
C. Water Sample Analysis					
GC Purgeable Halocarbons	3-40 ml organic analysis glass vials	40 ml	HCl, 4 °C	14 days	EPA Method 601 (GC)
TCL Volatile Organic Compounds +10 with Xylenes	3-40 ml organic analysis glass vials	40 ml	HCl, 4 °C	14 days	EPA Method 624 (GC/MS)
TCL Base/Neutral Extractable Organics +10	1,000 ml amber glass container	1,000 ml	4 °C	Extraction: 7 days Analysis: 40 days from extraction	EPA Method 625 (GC/MS)
TAL Metals	1,000 ml HDPE container	500 ml	HNO ₃ , 4 °C	28 days for Mercury, 6 months for all other elements	EPA Method 200 Series
Total Cyanide	1,000 ml HDPE container	500 ml	NaOH, 4 °C	14 days	CLP SOW Methodology, for Inorganic Analysis Multi-Media, Multi-Concentration, Document ILM04.0
Petroleum Hydrocarbons	1,000 ml amber glass container	1,000 ml	H ₂ SO ₄ , 4 °C	7 days	EPA Method 418.1
Total Organic Carbon	500 ml HDPE container	25 ml	H ₂ SO ₄ , 4 °C	14 days	EPA Method 415.1

* Holding time begins at time of sample collection

+ All chemicals preservatives will be ultra-pure grade or better

Note: Sample containers will be provided by laboratories and will be pre-cleaned and certified in accordance with EPA protocol.

300617



TABLE 3

**KLOCKNER PROPERTY
SUMMARY OF SAMPLING DUPLICATES AND FIELD BLANKS**

<u>Sample Media</u>	<u>Number of Samples</u>	<u>Duplicate</u>	<u>Estimated Field Blanks</u>	<u>Analysis Methodology</u>
Soil Samples	20	1	2	PHAL
	6	1	1	VOC
	2-5	1	1	BN
	7	1	1	TAL
	4	1	1	PHC
	1	1	1	CN
Soil Gas Samples	78	4	8	PHAL
	12	1	2	AROM
Geological Characterization	4	0	0	GS & TOC

KEY

PHAL - Purgeable Halocarbons
 VOC - Target Compound List Volatile Organic Compounds
 BN - Base/Neutral Extractable Organic Compounds
 TAL - Target Analytic List Metals
 PHC - Petroleum Hydrocarbons
 CN - Cyanide
 AROM - Non-Chlorinated Aromatic Volatile Organic Compounds
 GS - Grain Size
 TOC - Total Organic Carbon

**Note: Trip blanks will be collected for VOC and PHAL analysis with each shipment of field samples.
 If a shipment contains samples for VOCs, or VOC and PHAL, then the trip
 blank will be analyzed for VOC.**

300618



TABLE 4
KLOCKNER PROPERTY
SUMMARY OF QUANTITATION LIMITS - SOIL SAMPLES

Parameter	Quantitation Limit	NJRDCSCC	NJIGWSCC
Target Compound List			
Volatile Organic - GC/MS			
Method 8240 (ug/kg)			
Chloromethane	125	520,000	10,000
Bromomethane	125	79,000	1,000
Vinyl Chloride	125	2,000	10,000
Chloroethane	125	NS	NS
Methylene Chloride	125	49,000	1,000
Acetone	625	1,000,000	100,000
Carbon Disulfide	125	NS	NS
Trichlorofluoromethane	125	NS	NS
1,1-Dichloroethene	125	8,000	10,000
1,1-Dichloroethane	125	570,000	10,000
trans-1,2-Dichloroethene	125	1,000,000	50,000
cis-1,2-Dichloroethene	125	79,000	1,000
Chloroform	125	19,000	1,000
1,2-Dichloroethane	125	6,000	1,000
2-Butanone	625	1,000,000	50,000
1,1,1-Trichloroethane	125	210,000	50,000
Carbon Tetrachloride	125	2,000	1,000
Bromodichloromethane	125	11,000	1,000
1,2-Dichloropropane	125	10,000	NS
cis-1,3-Dichloropropene	125	4,000	1,000
Trichloroethene	125	23,000	1,000
Dibromochloromethane	125	110,000	1,000
1,1,2-Trichloroethane	125	22,000	1,000
Benzene	125	3,000	1,000
trans-1,3-Dichloropropene	125	4,000	1,000
2-Chloroethyl Vinyl Ether	125	NS	NS
Bromoform	125	86,000	1,000
4-Methyl-2-Pentanone	625	1,000,000	50,000
2-Hexanone	625	NS	NS
Tetrachloroethene	125	4,000	1,000
1,1,2,2-Tetrachloroethane	125	34,000	1,000
Toluene	125	1,000,000	500,000
Chlorobenzene	125	37,000	1,000
Ethylbenzene	125	1,000,000	100,000
Styrene	125	23,000	100,000
Xylene (Total)	125	410,000	10,000

300619



TABLE 4 (Continued)
KLOCKNER PROPERTY
SUMMARY OF QUANTITATION LIMITS - SOIL SAMPLES

Parameter	Quantitation Limit	NJRDCSCC	NJIGWSCC
Target Compound List			
Base/Neutrals - GC/MS Method			
8270 (ug/kg)			
N-Nitrosodimethylamine	330	NS	NS
bis(2-Chloroethyl) ether	330	660	10,000
1,3-Dichlorobenzene	330	5,100,000	100,000
1,4-Dichlorobenzene	330	570,000	100,000
1,2-Dichlorobenzene	330	5,100,000	50,000
bis(2-chloroisopropyl) ether	330	2,300,000	10,000
N-Nitroso-di-n-propylamine	330	NS	NS
Hexachloroethane	330	6,000	100,000
Nitrobenzene	330	28,000	10,000
Isophorone	330	1,100,000	50,000
bis(2-Chloroethoxy)methane	330	NS	NS
1,2,4-Trichlorobenzene	330	68,000	100,000
Naphthalene	16	230,000	100,000
4-Chloroaniline	330	230,000	NS
Hexachlorobutadiene	330	1,000	100,000
2-Methylnaphthalene	330	NS	NS
Hexachlorocyclopentadiene	330	400,000	100,000
2-Chloronaphthalene	330	NS	NS
2-Nitroaniline	330	NS	NS
Dimethylphthalate	330	10,000,000	50,000
Acenaphthylene	16	NS	NS
2,6-Dinitrotoluene	330	1,000	10,000
3-Nitroaniline	330	NS	NS
Acenaphthene	16	3,400,000	100,000
Dibenzofuran	330	NS	NS
2,4-Dinitrotoluene	330	1,000	10,000
Diethylphthalate	330	10,000,000	50,000
4-Chlorophenyl-phenylether	330	NS	NS
Fluorene	16	2,300,000	100,000
4-Nitroaniline	330	NS	NS
N-Nitrosodiphenylamine	330	140,000	100,000
4-Bromophenyl-phenylether	330	NS	NS
Hexachlorobenzene	330	660	100,000
Phenanthrene	16	NS	NS
Anthracene	16	10,000,000	100,000



TABLE 4 (Continued)
KLOCKNER PROPERTY
SUMMARY OF QUANTITATION LIMITS - SOIL SAMPLES

Parameter	Quantitation Limit	NJRDCSCC	NJIGWSCC
Carbazole	330	NS	NS
Di-n-butylphthalate	330	5,700,000	100,000
Fluoranthene	16	2,300,000	100,000
Pyrene	16	1,700,000	100,000
Benzidine	660	NS	NS
Butylbenzylphthalate	330	1,100,000	100,000
3,3'-Dichlorobenzidine	660	2,000	100,000
Benzo(a)anthracene	16	900	500,000
Chrysene	16	9,000	900,000
bis(2-Ethylhexyl)phthalate	330	49,000	100,000
Di-n-octylphthalate	330	1,100,000	100,000
Benzo(b)fluoranthene	16	900	50,000
Benzo(k)fluoranthene	16	900	500,000
Benzo(a)pyrene	16	660	100,000
Indeno(1,2,3-cd)pyrene	16	900	500,000
Dibenz(a,h)anthracene	16	660	100,000
Benzo(g,h,i)perylene	16	NS	NS
Pyridine	330	NS	NS
Aniline	660	NS	NS
Benzyl Alcohol	330	10,000,000	50,000
1,2-Diphenylhydrazine	330	NS	NS
Petroleum Hydrocarbons ⁽¹⁾ - Method 418.1 modified for soils with soxhlet extraction (mg/kg)	25	10,000	10,000
Total Organic Carbon ⁽¹⁾ EPA Region II Method (mg/kg)	100	NS	NS
Cyanide ⁽¹⁾ - CLP SOW (mg/kg)	0.5	1,100	NS

300621



TABLE 4 (Continued)
KLOCKNER PROPERTY
SUMMARY OF QUANTITATION LIMITS - SOIL SAMPLES

Parameter	Quantitation Limit	NJRDCSCC	NJIGWSCC
Target Analyte List Metals - Methods 6010/7471 ⁽²⁾ (mg/kg)			
Aluminum	10.9	NS	NS
Antimony	0.46	14	NS
Arsenic	0.30	20	NS
Barium	0.16	700	NS
Beryllium	0.02	1	NS
Cadmium	0.04	1	NS
Calcium	9.64	NS	NS
Chromium	0.1	78,000	NS
Cobalt	0.11	NS	NS
Copper	0.41	600	NS
Iron	4.75	NS	NS
Lead	0.17	400	NS
Magnesium	8.77	NS	NS
Manganese	0.09	NS	NS
Mercury	0.05	14	NS
Nickel	0.16	250	NS
Potassium	22.6	NS	NS
Selenium	0.47	63	NS
Silver	0.09	110	NS
Sodium	39.4	NS	NS
Thallium	0.44	2	NS
Vanadium	0.12	370	NS
Zinc	0.36	1,500	NS

300622



TABLE 4 (Continued)
KLOCKNER PROPERTY
SUMMARY OF QUANTITATION LIMITS - SOIL SAMPLES

Parameter	Quantitation Limit	NJRDCSCC	NJIGWSCC
Purgeable Halocarbons - GC/ELCD			
Method 8010 (ug/kg)			
Dichlorodifluoromethane	312.5	NS	NS
Chloromethane	312.5	520,000	10,000
Vinyl Chloride	312.5	2,000	10,000
Bromomethane	312.5	79,000	1,000
Chloroethane	312.5	NS	NS
Trichlorofluoromethane	312.5	NS	NS
1,1-Dichloroethene	312.5	8,000	10,000
Methylene Chloride	312.5	49,000	1,000
trans-1,2-Dichloroethene	312.5	1,000,000	50,000
1,1-Dichloroethane	312.5	570,000	10,000
cis-1,2-Dichloroethene	312.5	79,000	1,000
Chloroform	312.5	19,000	1,000
1,1,1-Trichloroethane	312.5	210,000	50,000
Carbon Tetrachloride	312.5	2,000	1,000
1,2-Dichloroethane	312.5	6,000	1,000
Trichloroethene	312.5	23,000	1,000
1,2-Dichloropropane	312.5	10,000	NS
Bromodichloromethane	312.5	11,000	1,000
2-Chloroethyl Vinyl Ether	312.5	NS	NS
cis-1,3-Dichloropropene	312.5	4,000	1,000
trans-1,3-Dichloropropene	312.5	4,000	1,000
1,1,2-Trichloroethane	312.5	22,000	1,000
Tetrachloroethene	312.5	4,000	1,000
Dibromochloromethane	312.5	110,000	1,000
Chlorobenzene	312.5	37,000	1,000
Bromoform	312.5	86,000	1,000
1,1,2,2-Tetrachloroethane	312.5	34,000	1,000
1,3-Dichlorobenzene	312.5	5,100,000	100,000
1,4-Dichlorobenzene	312.5	570,000	100,000
1,2-Dichlorobenzene	312.5	5,100,000	50,000

NJRDCSCC - July 11, 1996 New Jersey Residential Direct Contact Soil Cleanup Criteria Guideline.

NJIGWSCC - July 11, 1996 New Jersey Impact to Ground Water Soil Cleanup Criteria Guideline.

300623



TABLE 4 (Continued)
KLOCKNER PROPERTY
SUMMARY OF QUANTITATION LIMITS - SOIL SAMPLES

NS - No Soil Cleanup Criteria established.

1 - The values will change based upon the percent solids of the samples (for example a 50% solids sample will have twice the listed Quantitation Limit).

2 - For metals, the reporting limits that are listed are "Instrument Detection Limits" that are updated quarterly.

Note 1: All of the reporting limits are subject to change based upon percent solids, sample matrix required dilutions or other changes in laboratory procedures that may be required.

Note 2: The quantitation limits provided in Table 4 are those obtained by the laboratory for samples analyzed by SW846 methods. The laboratory has obtained experimental method detection limits below these levels.

Note 3: The quantitation limits provided for Volatile Organics and Purgeable Halocarbons include a dilution factor of 125 which is associated with field extraction of the sample with Methanol.



TABLE 4 (Continued)
KLOCKNER PROPERTY
SUMMARY OF QUANTITATION LIMITS - BLANK WATER SAMPLES

Parameter	Quantitation Limit
Target Compound List	
Volatile Organic - GC/MS	
Method 624 (ug/l)	
Chloromethane	0.9
Bromomethane	0.3
Vinyl Chloride	0.4
Chloroethane	1.0
Methylene Chloride	1.0
Acetone	5.0
Carbon Disulfide	1.0
Trichlorofluoromethane	0.2
1,1-Dichloroethene	0.6
1,1-Dichloroethane	0.3
trans-1,2-Dichloroethene	0.3
cis-1,2-Dichloroethene	1.0
Chloroform	0.2
1,2-Dichloroethane	0.2
2-Butanone	5.0
1,1,1-Trichloroethane	0.2
Carbon Tetrachloride	0.2
Bromodichloromethane	0.2
1,2-Dichloropropane	0.5
cis-1,3-Dichloropropene	0.3
Trichloroethene	0.4
Dibromochloromethane	0.2
1,1,2-Trichloroethane	0.4
Benzene	0.2
trans-1,3-Dichloropropene	0.3
2-Chloroethyl Vinyl Ether	0.5
Bromoform	0.3
4-Methyl-2-Pentanone	5.0
2-Hexanone	5.0
Tetrachloroethene	0.1
1,1,2,2-Tetrachloroethane	0.3
Toluene	0.2
Chlorobenzene	0.1
Ethylbenzene	0.2
Styrene	1.0
Xylene (Total)	1.0



TABLE 4 (Continued)
KLOCKNER PROPERTY
SUMMARY OF QUANTITION LIMITS - BLANK WATER SAMPLES

Parameter	Quantitation Limit
Target Compound List	
Volatile Organic - GC/MS	
Method 625 (ug/l)	
N-Nitrosodimethylamine	0.7
bis(2-Chloroethyl) ether	1.2
1,3-Dichlorobenzene	3.4
1,4-Dichlorobenzene	3.5
1,2-Dichlorobenzene	3.4
bis(2-chloroisopropyl) ether	1.4
N-Nitroso-di-n-propylamine	1.5
Hexachloroethane	2.4
Nitrobenzene	1.5
Isophorone	1.7
bis(2-Chloroethoxy)methane	1.6
1,2,4-Trichlorobenzene	3.7
Naphthalene	2.5
4-Chloroaniline	5.0
Hexachlorobutadiene	2.2
2-Methylnaphthalene	5.0
Hexachlorocyclopentadiene	1.6
2-Chloronaphthalene	3.2
2-Nitroaniline	5.0
Dimethylphthalate	1.3
Acenaphthylene	2.0
2,6-Dinitrotoluene	1.5
3-Nitroaniline	5.0
Acenaphthene	2.8
Dibenzofuran	5.0
2,4-Dinitrotoluene	1.5
Diethylphthalate	1.2
4-Chlorophenyl-phenylether	2.9
Fluorene	2.0
4-Nitroaniline	5.0
N-Nitrosodiphenylamine	1.1
4-Bromophenyl-phenylether	2.0
Hexachlorobenzene	1.2
Phenanthrene	1.0
Anthracene	1.1



TABLE 4 (Continued)
KLOCKNER PROPERTY
SUMMARY OF QUANTITION LIMITS - BLANK WATER SAMPLES

Parameter	Quantitation Limit
Carbazole	5.0
Di-n-butylphthalate	1.0
Fluoranthene	1.1
Pyrene	0.6
Benzdine	0.5
Butylbenzylphthalate	0.7
3,3'-Dichlorobenzidine	1.4
Benzo(a)anthracene	0.8
Chrysene	0.9
bis(2-Ethylhexyl)phthalate	1.2
Di-n-octylphthalate	1.0
Benzo(b)fluoranthene	0.8
Benzo(k)fluoranthene	0.9
Benzo(a)pyrene	0.8
Indeno(1,2,3-cd)pyrene	0.7
Dibenz(a,h)anthracene	0.8
Benzo(g,h,i)perylene	0.8
Pyridine	5.0
Aniline	5.0
Benzyl Alcohol	5.0
1,2-Diphenylhydrazine	5.0
Petroleum Hydrocarbons Method 418.1 (mg/l)	1
Total Organic Carbon EPA Method 415.1 (mg/l)	1
Cyanide - CLP SOW (ug/l)	10



TABLE 4 (Continued)
KLOCKNER PROPERTY
SUMMARY OF QUANTITION LIMITS - BLANK WATER SAMPLES

Parameter	Quantitation Limit
Target Analyte List Metals - Method 200 Series ⁽²⁾ (ug/l)	
Aluminum	109
Antimony	4.6
Arsenic	3.0
Barium	1.6
Beryllium	0.20
Cadmium	0.40
Calcium	96.4
Chromium	1.0
Cobalt	1.1
Copper	4.1
Iron	47.5
Lead	1.7
Magnesium	87.7
Manganese	0.90
Mercury (Method 245.1)	0.10
Nickel	1.6
Potassium	226
Selenium	4.7
Silver	0.90
Sodium	394
Thallium	4.4
Vanadium	1.2
Zinc	3.6

300628



TABLE 4 (Continued)
KLOCKNER PROPERTY
SUMMARY OF QUANTITION LIMITS - BLANK WATER SAMPLES

Parameter	Quantitation Limit
Purgeable Halocarbons - GC/ELCD	
Method 601 (ug/l)	
Dichlorodifluoromethane	0.44
Chloromethane	0.55
Vinyl Chloride	0.14
Bromomethane	0.39
Chloroethane	0.33
Trichlorofluoromethane	0.36
1,1-Dichloroethene	0.25
Methylene Chloride	0.26
trans-1,2-Dichloroethene	0.28
1,1-Dichloroethane	0.28
cis-1,2-Dichloroethene	0.50
Chloroform	0.23
1,1,1-Trichloroethane	0.24
Carbon Tetrachloride	0.26
1,2-Dichloroethane	0.19
Trichloroethene	0.25
1,2-Dichloropropane	0.19
Bromodichloromethane	0.16
2-Chloroethyl Vinyl Ether	0.86
cis-1,3-Dichloropropene	0.27
trans-1,3-Dichloropropene	0.28
1,1,2-Trichloroethane	0.10
Tetrachloroethene	0.28
Dibromochloromethane	0.07
Chlorobenzene	0.35
Bromoform	0.20
1,1,2,2-Tetrachloroethane	0.21
1,3-Dichlorobenzene	0.23
1,4-Dichlorobenzene	0.22
1,2-Dichlorobenzene	0.19

2 - For metals, the reporting limits that are listed are "Instrument Detection Limits" that are updated quarterly.

Note 1: All of the reporting limits are subject to change based upon percent solids, sample matrix required dilutions or other changes in laboratory procedures that may be required.

Note 2: The quantitation limits provided in Table 4 are those obtained by the laboratory for samples analyzed by EPA methods. The laboratory has obtained experimental method detection limits below these levels.



Figures

300630

FIGURES

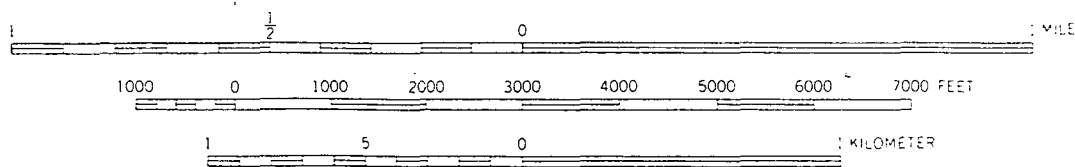
- 2.1 Site Location on USGS Dover Quadrangle
- 2.2 Site Map of Klockner Property
- 2.3 Rockaway Borough Well Location Map
- 4.1 Proposed Soil Gas Survey - Building 12
- 4.2 Proposed Soil Sample Locations - Building 12
- 4.3 Proposed Soil Gas Survey - Building 13

300631

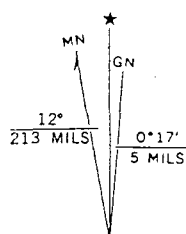




SCALE 1:24000



300632



UTM GRID AND 1981 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET



QUADRANGLE LOCATION



THE
WHITMAN
Companies,
INC.

KLOCKNER & KLOCKNER PROPERTY
ROCKAWAY BOROUGH
MORRIS COUNTY, NJ

SITE LOCATION ON USGS
DOVER QUADRANGLE

ORIG. BY: MM

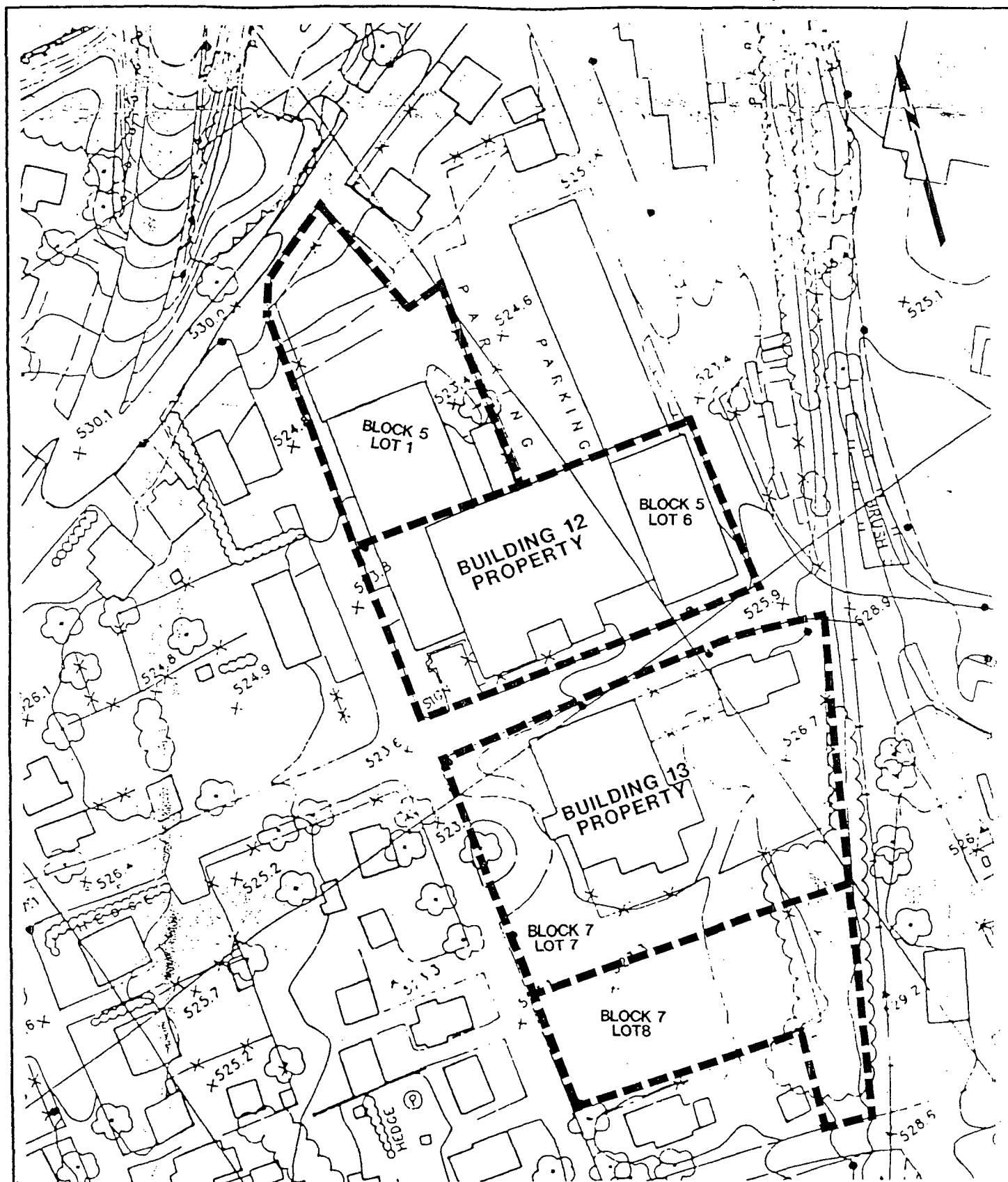
DWG. BY: *A. Villar*

CHK. BY: MM

DWG. #:

DATE: MAY 1996

FIGURE: 2.1



SOURCE:

300633

AERIAL SURVEY DATED JUNE 1994 PREPARED
BY ROBINSON AERIAL SURVEY'S INC. FOR
CONESTOGA-ROVERS & ASSOCIATES

REVISED MAY 1997



THE
WHITMAN
Companies,
INC.

KLOCKNER & KLOCKNER PROPERTY
ROCKAWAY BOROUGH
MORRIS COUNTY, NJ

SITE MAP OF
KLOCKNER PROPERTY

ORIG. BY: MM

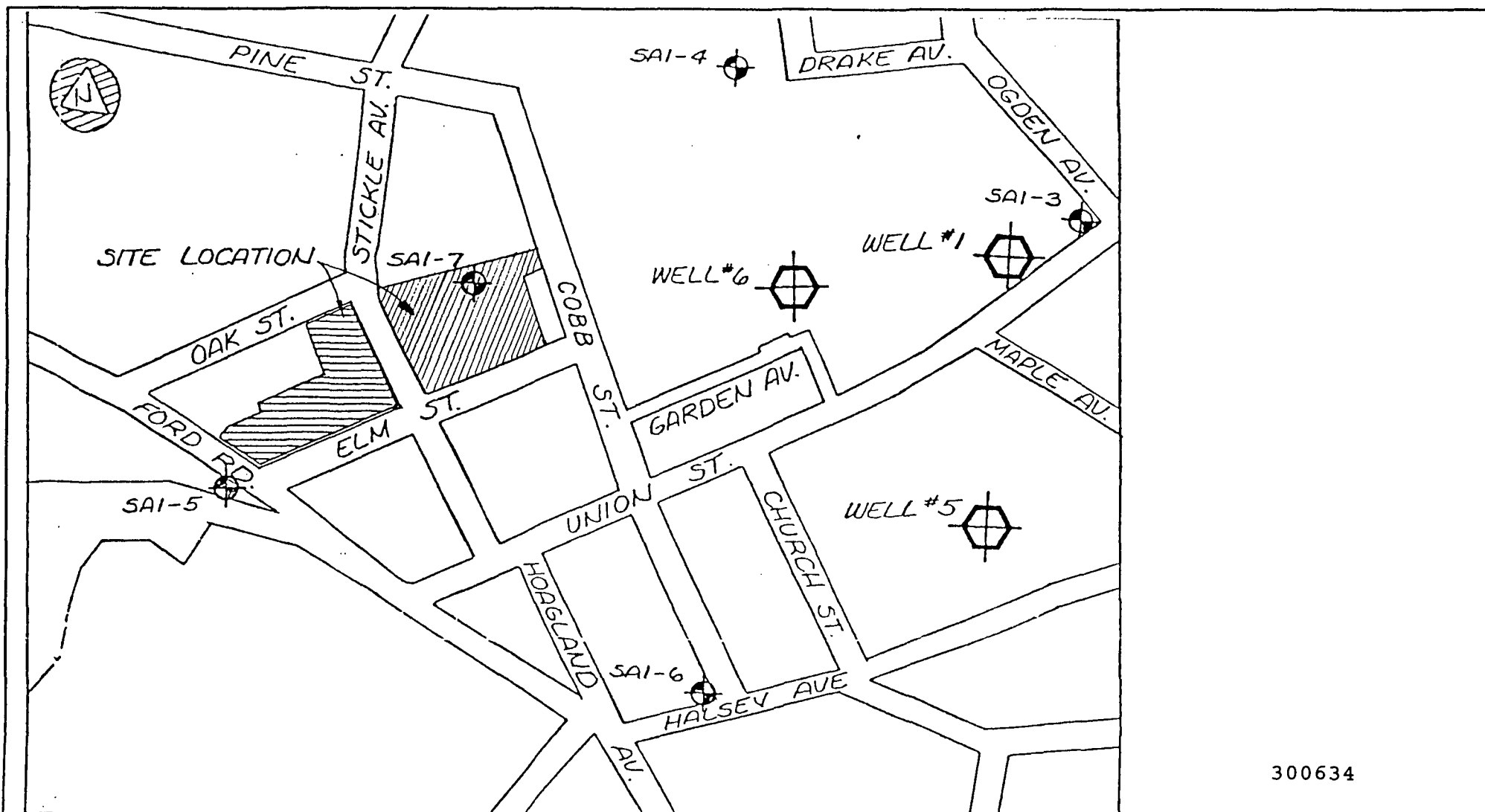
DWG. BY: S. SMITH

CHK. BY: MM

DWG. #:

DATE: NOV. 1995

FIGURE: 2.2



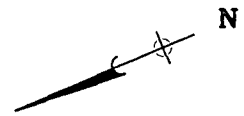
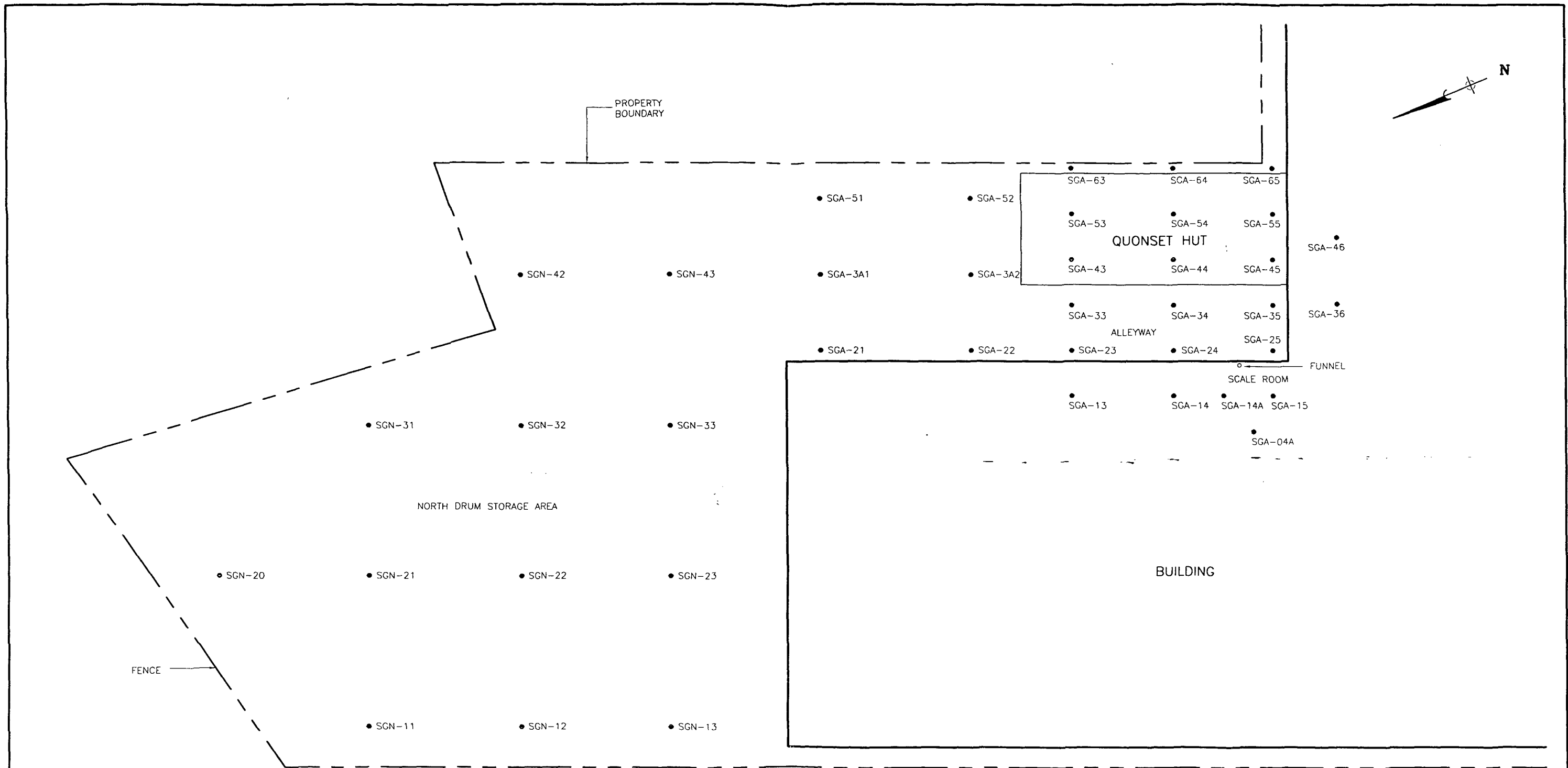
300634

SCALE: 1"=300'

LEGEND
 NJDEP MONITORING WELL

SOURCE: FIRST ENVIRONMENT

 THE WHITMAN Companies, INC.	KLOCKNER & KLOCKNER PROPERTY ROCKAWAY BOROUGH MORRIS COUNTY, NJ	
	ROCKAWAY BOROUGH WELL LOCATION MAP	
ORIG. BY: MM	DWG. BY: <i>A. Villar</i>	CHK. BY: MM
DWG. #:	DATE: MAY 1996	FIGURE: 2.3




LEGEND

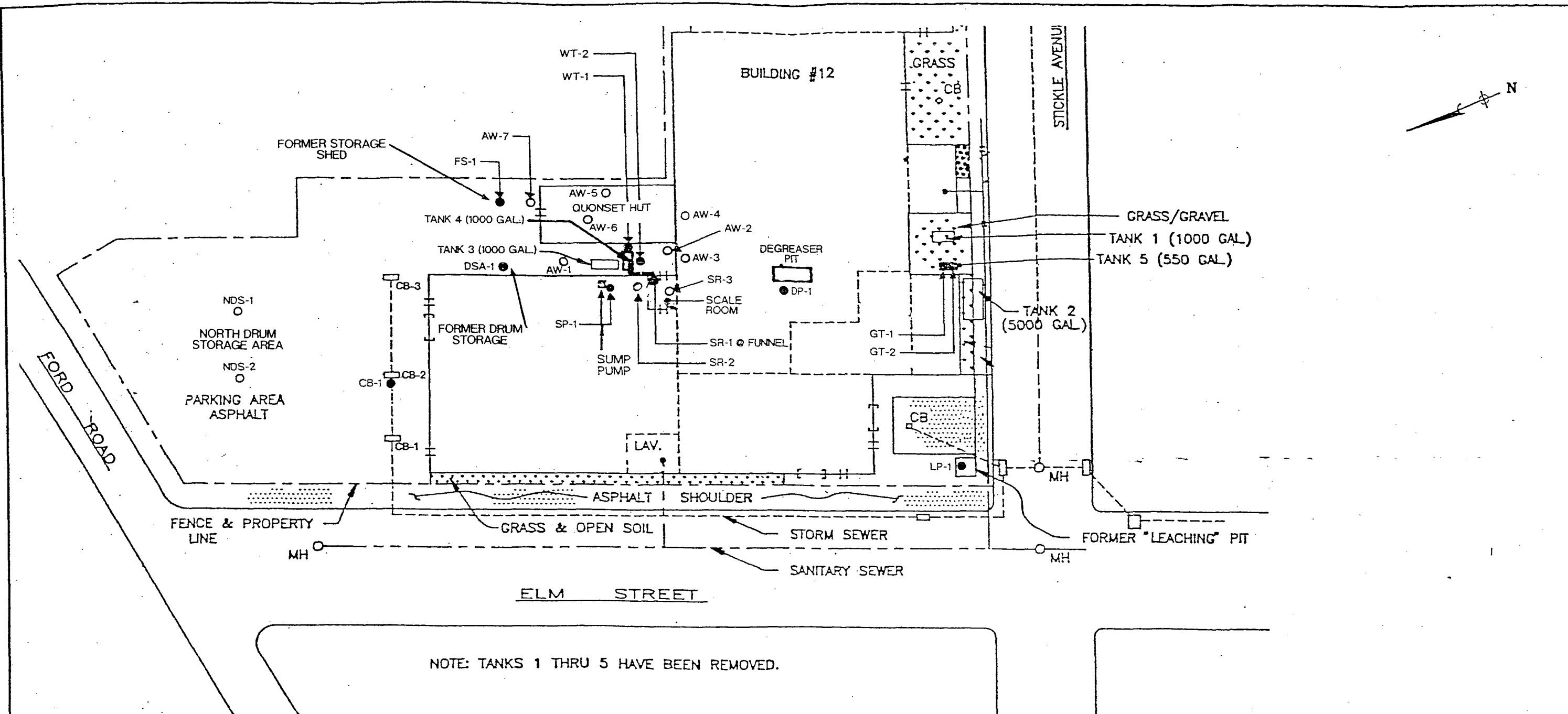
- - PROPOSED SOIL GAS SAMPLE LOCATION
- SGN-23 - NORTHERN DRUM STORAGE AREA SAMPLE
- SGA-23 - ALLEYWAY AREA SAMPLE
- GRID ROW LOCATION
- SGA-3A4 — GRID COLUMN LOCATION
- LOCATION OFF OF GRID

SCALE



300635

	KLOCKNER & KLOCKNER PROPERTY ROCKAWAY BOROUGH MORRIS COUNTY, NJ		
	PROPOSED SOIL GAS SURVEY BUILDING 12		
ORIG. BY: MM	DWG. BY: A. Villar	CHK. BY: MM	
DWG. #: 9503021	DATE: MAY 1996	FIGURE: 4.1	

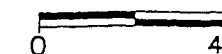


LEGEND

- CB - CATCH BASIN
- SP-1 - SAMPLE DESIGNATION (TYPICAL)
- - PROPOSED SOIL SAMPLE LOCATION
- - POTENTIAL SOIL SAMPLE LOCATION
ACTUAL LOCATIONS WILL BE BASED
ON RESULTS OF SOIL GAS SURVEY

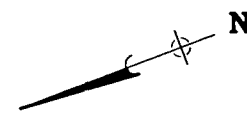
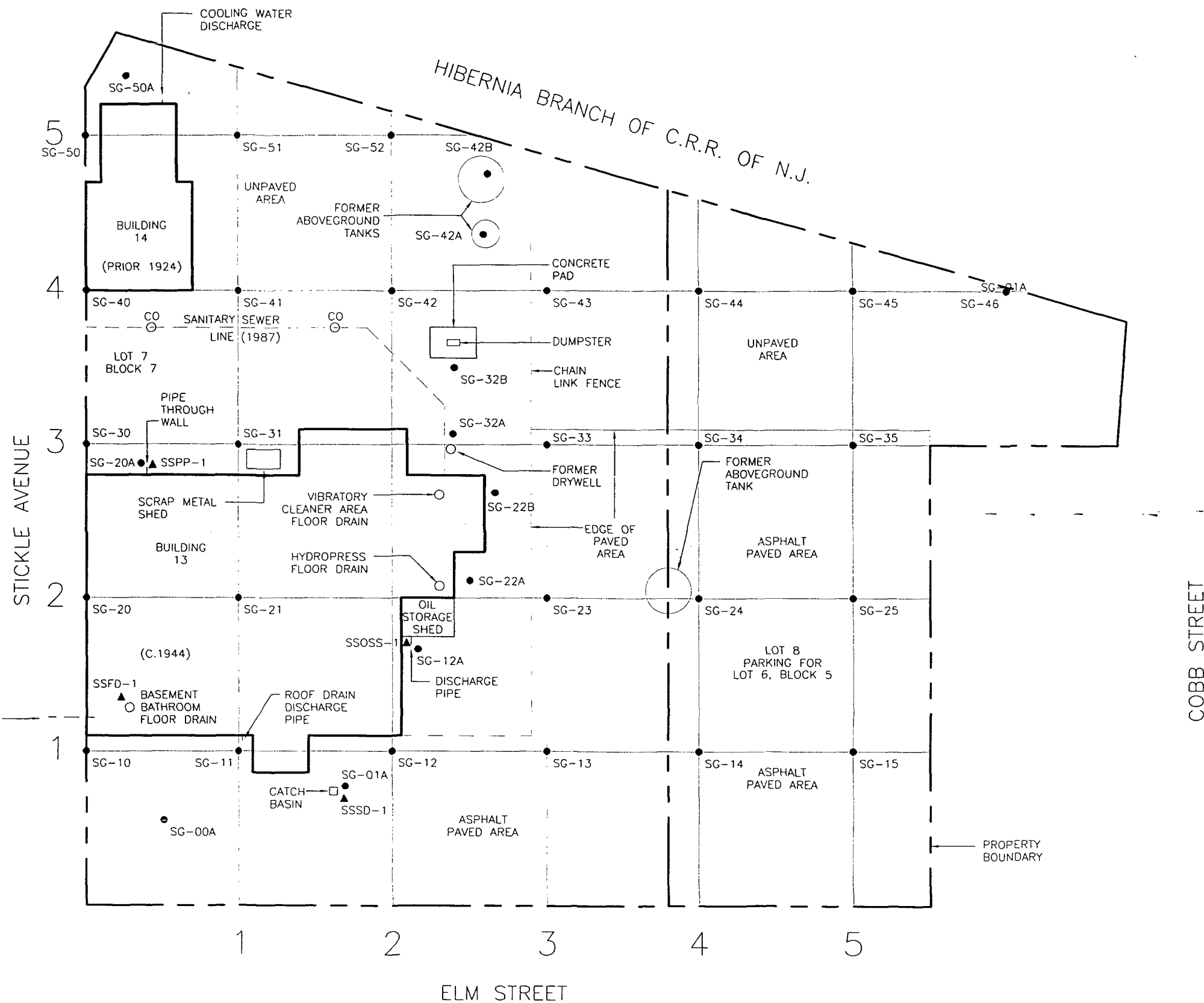
ALL SAMPLE LOCATIONS ARE SOIL SAMPLES.

SCALE



	KLOCKNER & KLOCKNER PROPERTY ROCKAWAY BOROUGH MORRIS COUNTY, NJ	
	PROPOSED SOIL SAMPLE LOCATIONS BUILDING 12	
ORIG. BY: MM	DWG. BY: A. Villar	CHK. BY: MM
DWG. #:	DATE: MAY, 1996	FIGURE: 4.2

REVISED MAY 1997




LEGEND

- SG-01 - PROPOSED SOIL GAS SURVEY SAMPLE LOCATION
- ▲ SSSD-1 - PROPOSED SOIL SAMPLE LOCATION
- GRID ROW LOCATION
- SG-32B - LOCATION OFF GRID
- GRID COLUMN LOCATION

300637

SCALE



	KLOCKNER & KLOCKNER PROPERTY ROCKAWAY BOROUGH MORRIS COUNTY, NJ		
	SOIL GAS SURVEY BUILDING 13		
ORIG. BY: MM	DWG. BY: S. Smith	CHK. BY: MM	
DWG.#: 950302X	DATE: MAY, 1996	FIGURE: 4.3	

REVISED MAY 1997

APPENDIX A
SOIL GAS SURVEY QUALITY ASSURANCE PLAN

300639



**QUALITY ASSURANCE PLAN
for
DIRECT PUSH SCREENING SERVICES**

Prepared for
THE WHITMAN COMPANIES
44 West Ferris Road
East Brunswick, NJ 08816

Prepared by
TARGET ENVIRONMENTAL SERVICES, INC.
9180 Rumsey Road
Columbia, MD 21045
(410) 992-9792

March 14, 1996

300640

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1.0 Project Description

Direct push collection and analysis of samples from the shallow subsurface will provide data on the identity and concentrations of any volatile organic compounds which may be present, without generating waste from soil cuttings.

Samples will be analyzed on a laboratory-grade gas chromatograph equipped with capillary columns, thermal oven, and with a data processor and associated hardware. Each instrument is appropriately calibrated at the beginning of the project, and as needed for the duration of the project using an instrument-response curve and injection of standards of known concentrations. Calibration checks will be performed at a minimum of twice a day. Retention times of the compounds in the standards are used to identify the unknown compounds in field samples, and their response factors are used in calculating actual concentrations. Replicate analyses will be performed on at least every tenth field sample (see Section 8.0).

Sometimes, more than one compound will elute at the same retention time. When this happens, the results will be reported as a coelutant pair. If further resolution is desired, a representative sample from any given area of interest will be selected for analysis by GC/MS. All GC/MS analyses will be performed by Maryland Spectral Services, Inc., Baltimore, Maryland.

The results of the analyses will be interpreted and reported by TARGET in the form of a written report including a summary of background information, descriptions of sampling and analytical procedures, tabulated analytical results (including QA/QC), a scaled base map with labelled sample locations, contoured maps (as appropriate) of individual component concentrations, and a discussion and interpretation of the findings.

2.0 Project Personnel

2.1 Management Personnel

NED TILLMAN is the founder and President of **The TARGET Companies, Inc.** and its subsidiary, **TARGET Environmental Services, Inc.** He is responsible for the overall direction of corporate activities, as well as the quality of corporate services. He plays an active role in management, research and development, and client interaction. Geochemistry and environmental project management are Tillman's areas of expertise. The 18 years of experience in these fields has afforded him the opportunity to develop and refine various forms of surface and subsurface sampling technologies which have been instrumental in the development of **TARGET's** full range of soil gas surveying methods. Prior to founding **TARGET** in 1981, Mr. Tillman's professional and management experience included serving as senior consultant for several major geotechnical consulting firms on numerous projects in the Middle East, Canada and most parts of the U.S. Tillman has published and presented numerous papers on the investigation of contaminants in the subsurface and has conducted seminars on environmental issues. He has chaired a committee on ground water problems for the State of Maryland and holds certifications from the American Association of Petroleum Geologists (#3159) and the American Institute of Professional Geologists (#6245). He is a registered geologist in the state of Delaware. Mr. Tillman has an MS in Geochemistry from Syracuse University (1973) and a BS in Geochemistry from Franklin & Marshall (1971).

TIMOTHY W. NIBLETT is Vice President and Senior Project Manager for **TARGET**. Mr. Niblett's responsibilities include scheduling, coordinating and organizing the field activities for client projects. He works directly with clients to determine the project site background and client information needs. From this, he designs the site survey to fulfill the specified requirements of the client, while working closely with **TARGET's** Health and Safety Officer to address the health and safety issues on each project site. He has extensive experience in soil gas sampling and has, in conjunction with other senior field management, developed the company's strict sample acquisition and QA/QC field procedures. He is responsible for coordinating all field scheduling, equipment and teams, and directs field managers in order to ensure smooth project operations. Mr. Niblett has the authority to commit company personnel and resources to a project in progress in order to solve problems and meet client's schedules. He has a BS in Environmental Science from Frostburg University (1981).

LANNY HELMS holds the position of Project Manager with **TARGET**. He has been active in geotechnical and environmental project management in the Mid-Atlantic area for 14 years. At **TARGET**, he is responsible for the management and direction of soil gas, water and soil sampling projects and the planning and design of project and field activities. Mr. Helms is a member of the Association of Engineering Geologists and a registered Professional Geologist in the Commonwealth of Virginia and the State of Delaware and has a BS in Geology from the University of Maryland (1979).

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BRIAN ABRAHAM is Laboratory Director at **TARGET**. He is responsible for directing all in-house laboratory operations, including overseeing the maintenance and calibration of various gas chromatographs and the development and implementation of methods for new chromatographic technologies. Dr. Abraham has over 7 years of experience in the field of Analytical Chemistry. He is currently Vice President and the director of analytical operations for **TARGET**. Previous to this position he was director of operations for SiteWorks, Inc. managing all company personnel including several Ph.D. scientists. Dr. Abraham has served as project director on several EPA, DoE, DoD, and USDA Superfund (and non-Superfund) sites throughout the country. Dr. Abraham has developed novel analytical methods and instrumentation which have been cited through numerous publications. Methods developed by Dr. Abraham have been accepted by the USEPA, USATHAMA, DoE, and DoD as rapid field quantitative methods capable of producing high level quality (EPA Level III and IV) data for use in expedited site characterization studies for remediation and risk assessment.

GUY AULD is currently Manager of **TARGET's** Report Writing Department. As senior data review analyst, Mr. Auld is responsible for the overall quality, accuracy and completeness of laboratory data. He also performs the correction and hand contouring of **TARGET's** computer generated isoconcentration maps, directs the interpretation of results and the integration of data sets, as well as the compilation and preparation of **TARGET's** comprehensive written reports. Prior to working in the Report Writing Department, he was a Project Manager at **TARGET** and he worked in the field as a Field Consultant. This experience has helped him to understand all phases of the projects and to compile detailed reports of the work. Mr. Auld has a BS in Geology from the University of Maryland, College Park (1987).

2.2 Laboratory Personnel

MICHAEL MARRALE is a In-Field Analysis Coordinator for **TARGET's** Columbia office, the California Regional Office, and the St. Louis/Dallas Regional Office. He is responsible for the daily operations of the mobile laboratories as well as maintaining standard operating procedures and quality assurance/quality control procedures for field analysis. Mr. Marrale has a B.A. in Environmental Science from the University of Virginia.

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3.0 Quality Assurance Objectives

3.1 Precision

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Precision will be assessed by the comparison of replicate analyses. A replicate analysis will be obtained for every tenth sample. The variation between replicate analyses must be less than 20%. If the variation is outside this window, the system will be checked for leaks or other problems, comments will be noted in the system log, and if necessary, selected samples will be re-analyzed.

3.2 Accuracy

Accuracy will be determined by the analysis of field blanks, lab blanks and check standards. Retention times of the compounds in the standards are used to identify the unknown compounds in field samples, and their response factors are used in calculating actual concentrations. Accuracy will be estimated by comparing measured check standard concentrations of each analyte with known concentrations in the stock gas and comparing the results of replicate analyses. The data quality objective with respect to field and lab blanks is to achieve analytical concentrations below the quantification limit for all analytes. Field blanks will be collected at the beginning and end of each day, after every twentieth sample. Lab blanks will be analyzed after every tenth sample. Check standards will be run at the beginning and end of every day. Duplicate analyses will be performed on at least every tenth field sample.

When contamination is determined to be present in a lab or field blank, an assessment as to the effect of the contamination on the validity of the data from any field sample locations will be made. If necessary, field samples will be recollected from the affected areas and appropriate notations will be made in the field books.

3.3 Representativeness

Representativeness of data collection will be addressed by careful preparation of the sampling program. A sufficient and proper number of samples and location will assure that sample data accurately and precisely represent selected characteristics of the soil gas.

4.0 Laboratory Support Facilities

The primary operation of TARGET's laboratory is to analyze soil gas/headspace/vapor samples. TARGET operates ten Shimadzu gas chromatographs, equipped with auto samplers, flame-ionization detector (FID), electron capture detector (ECD), and computerized data systems, which are dedicated to the 24-hour analysis of vapor samples. Each GC can routinely analyze 50 soil gas samples/day under standard run parameters. The fixed-base laboratory operates seven days/week. Providing allowances for equipment maintenance and additional processing for highly contaminated samples, the laboratory can analyze approximately 1,200 samples/week. The laboratory is also equipped to

analyze soil and water samples by purge and trap utilizing GC/PID (photo-ionization detector) and Hall detector. TARGET's infield laboratories use the same equipment found in the fixed-laboratory and are supported by the equipment and personnel based at TARGET's corporate headquarters.

5.0 Health and Safety and Personnel Training Procedures

TARGET recognizes the importance of Health & Safety at each project site. For each project, TARGET's Corporate Health & Safety Officer reviews all materials provided by the client, reviews the conditions with known regulations and safety concerns and then either accepts the client's Site Safety Plan or prepares a more stringent addendum to that plan specific to TARGET's field activities for the site. All TARGET field personnel have successfully completed a 40-hour Health and Safety training course, fulfilling the initial training requirements as specified in OSHA's interim regulation for hazardous waste operations [OSHA 29 CFR 1910.120 (e) and SARA 126]. Annual 8-hour updates and Supervisory Courses have been completed as appropriate. TARGET owns and maintains all equipment necessary for operations under Levels C and B, including protective suits, respirators, and SCBA's.

TARGET provides each new employee with a training program appropriate to his/her position. Every technical or management employee is introduced into TARGET's dedication to excellence through a mentor system coupled with hands-on training until they reach a level of proficiency acceptable to their supervisor, and are able to work more independently. Local training seminars are attended by technical and management personnel, when appropriate. New field technicians are closely supervised by a Senior Field Technician during the first six months of employment (or until such supervision is no longer necessary).

6.0 Field Sampling Procedures

Upon arrival at the site, TARGET's 2-man team will check the site map for accuracy, measure out the sampling grid, and mark each location with a pin flag or paint. An electric hammer-drill will be used to penetrate pavement or compact soil, where necessary. TARGET personnel will repair such holes upon completion of sampling.

6.1 Sample Collection Procedures

Soil gas samples are to be collected at pre-determined locations with on-site additions or deletions as directed by the client and actual conditions. The samples will be taken from a depth greater than 2 feet to avoid surface interferences. The actual sampling depth will depend on local conditions (i.e. depth to ground water or bedrock) and field observations.

Prior to manual sampling (4-5' depths), the entire sampling system is purged with a volume of ambient air (filtered through a charcoal canister) or nitrogen no less than 20 times the volume of the sampling apparatus void space. To collect the samples, a 1/2-inch hole is produced to the sampling depth by using a manual slide hammer or drive rod. After the slide hammer is removed from the hole, a specially designed stainless steel probe is inserted to the full depth of the hole and

packed off to isolate the probe's perforations from the atmosphere. In-situ soil gas is withdrawn through the probe, used to displace the atmospheric air or nitrogen from the sampling system, and vented to the atmosphere. A second sample of soil gas is withdrawn through the probe and encapsulated in a pre-evacuated glass vial at two atmospheres of pressure.

Prior to sampling with the hydraulic probe, the entire sampling system will be purged as described above, and then TARGET's truck-mounted hydraulic probe will be used to achieve the sampling depth. Interconnected 3' lengths of 1"-diameter steel pipe will be advanced to the sampling depth. The bottom of the pipe will be opened and a small diameter stainless steel probe will be lowered through the steel casing to the bottom of the hole. A packer will be inflated just above the probe perforations to isolate the sampling zone from the annulus. In-situ soil gas is withdrawn through the probe and used to displace the atmospheric air or nitrogen from the sampling system and then vented to the atmosphere. A second sample of soil gas is withdrawn through the probe and encapsulated in a pre-evacuated glass vial at two atmospheres of pressure.

This two step sampling procedure allows for an initial gas draw to fully "charge" the sampling apparatus with soil gas, and remove all purge gases from the system. The second draw, then, produces a truly representative soil gas sample. Small consistent volumes of extracted soil gas help to insure consistent sampling of in-situ vapors. The sample is encapsulated in a glass vial to reduce the risk of volatile migration which may occur through tedlar, when bags are used. Also, encapsulating the sample in a glass vial allows greater holding times and repeat analysis for confirmation analyses or additional analysis (i.e. mass spectroscopy).

This sampling system is designed to collect small, measured, uniform sample volumes, therefore minimizing variables and obtaining the most representative sample available from each sample location.

To collect ground water samples, TARGET's hydraulic probe will be used to drive 1.25" diameter steel pipe to the prescribed depth (conditions permitting) at each location. The bottom of the pipe will be opened or the pipe will be replaced with a slotted PVC pipe to allow water to enter from the soil. TARGET personnel will gauge the actual depth to ground water in the initial hole. Samples of ground water will be collected with a teflon sampling tube or a stainless steel mini-bailer lowered through the steel pipe. Each water sample will be stored in a 40ml EPA-clean amber glass VOA vial. Samples will be pH adjusted to inhibit microbial breakdown of contaminants and refrigerated, pending analysis.

Soil samples will be collected by hydraulically driving a 1.25" diameter piston-type sampler to the top of the desired sample interval (conditions permitting). The piston within the sampler will then be released and the pipe will be advanced through the target interval. The soil core will enter the sampler, which contains a new non-reactive plastic or stainless steel liner. After the drive rod is removed from the soil, the liner containing the soil column can be removed. The liner may be capped at the ends or the soil may be extruded into 40 ml glass vials and

sealed with teflon-lined caps. If a plastic liner is used, it may be opened longitudinally to expose the soil, and a specific section of the sample can be chosen for analysis. The samples will be refrigerated, pending analysis.

6.2 Field Decontamination Procedures

The following procedures have been established by **TARGET** to protect sample integrity and limit cross-contamination from one sample to another. The sampling probes and apparatus are decontaminated internally and externally prior to each day's sample collection, and at additional intervals as judged appropriate by the sampling team.

Prior to each day's work, the sampling equipment is washed with a Contrad cleaner/distilled water solution, and wiped dry with clean paper towels. The equipment is rinsed with distilled water and then wiped dry with clean paper towels. The interior of the probe is flushed with Contrad/distilled water and purged for approximately 30 seconds with 20 psi of ultra-zero grade air, prepurified nitrogen, or filtered ambient air.

Prior to each sample extraction, the sampling probe and apparatus (including valves and injection needle) are purged with a volume of filtered ambient air at least 50 times the void space volume of the sampling system prior to each sample extraction. The sampling apparatus is then purged with in-situ soil gas at least 20 void space volumes of the sampling system. This in-situ soil gas is withdrawn through the probe and used to purge the filtered air from the sampling equipment and vented to the atmosphere.

Prior to each day's work, the sampling equipment is washed with a non-phosphate cleaner/distilled water solution, and wiped dry with clean paper towels. The equipment is rinsed with distilled water and then wiped dry with clean paper towels. Prior to each sample collection, the lower sections of pipe and the sampling apparatus are wiped clean.

Additional Decontamination will be done when potentially contaminated water or soil is pulled into the vapor sampling line or if field observations (such as odors, stains, or client information) indicate that a specific sample may be highly contaminated. Other Decontamination procedures may be employed if requested. (ie. hot water pressure washer, decontamination pad, methonal rinse...)

6.3 Field Control Samples

Vapor field blanks are collected by drawing prepurified nitrogen or ambient air (filtered through an MSA organic cartridge filter) through the sampling apparatus and probe prior to each day's sampling activities, after every 20th sample, between sites, and at the conclusion of each sampling day. If water or soil samples are collected, equipment rinseate blanks will be collected at the beginning and end of each day. These field control samples are labeled and analyzed in the same manner as actual field samples and are visually indistinguishable from them.

6.4 Field Documentation Procedures

A field book will be used to document actual field conditions and procedures. General site information and changes to standard operating procedures are noted as well as specific information about each sample point. Field documentation at each sample location includes:

- sample identification
- depth to sample
- general area observations
- equipment used (i.e. manual or probe)
- general remarks
- general description of the sample location

Although this information is not usually reported, it is used when preparing the project report to ensure accurate interpretation of the sample data.

6.5 Sample Custody

Samples are logged on a Chain of Custody form which accompanies the samples during custody transfers, or transport to the analytical laboratory.

At the end of each sampling day, samples are recounted and chain-of-custody forms are completed for all samples. All information on the chain-of-custody form and the sample labels is checked against the field log book entries before leaving the site.

The field personnel are responsible for the care and custody of the collected samples until properly dispatched to the receiving laboratory or turned over to an assigned custodian or overnight carrier. Upon transfer of custody, the chain-of-custody form is signed by a member of the sampling team.

Samples will be hand delivered to the laboratory or may be shipped by overnight carrier. Overnight carriers (i.e. Federal Express, UPS, etc.) do not sign chain-of-custody forms; therefore, the chain-of-custody records will be sealed within each container of samples. The receipt or airbill for the shipment will be retained in the project file as part of the chain-of-custody documentation.

If the samples are analyzed in **TARGET's** on-site laboratory, after the analysis the samples will be delivered to **TARGET's** corporate laboratory in Columbia, Maryland. Overnight carriers (i.e. Federal Express, UPS, etc.) do not sign chain-of-custody forms; therefore, the chain-of-custody records will be sealed within each container of samples. The receipt or airbill for the shipment will be retained in the project file as part of the chain-of-custody documentation.

All chain-of-custody forms received by the laboratory are signed and dated by the laboratory sample custodian and returned to the project file.

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7.0 Analytical Procedures

7.1.2 Calibration (Mobile Laboratory)

FID analysis is conducted at Range 1, while ECD analysis is conducted at Range 0. Three-point least squares linear regression calibration curves are generated for each detector as needed and the correlation coefficients are examined for each standardized analyte. Correlation coefficients must be greater than 0.99. The response factor is then used to quantify the concentration of analytes in samples. Following the initial three-point calibration, check standards are analyzed at the beginning and end of each day to ensure retention time and response stability. Windows for retention times will be set using the narrowest time band possible (usually 0.05 - 0.1 minutes) without including non-standardized peaks.

The FID and ECD stock standards are replaced as needed from pre-prepared (Scott Specialty Gases) cylinders that contain mixtures of our standard analytes. A volume of gas is extracted from the main pressurized cylinder. The line is purged to eliminate contamination or dilution and then a one liter Tedlar bag with a teflon lined septa is filled. Each Tedlar bag is used only once. Aliquots from the Tedlar bags are withdrawn using Hamilton gas tight glass syringes and are then injected into 30 ml pre-capped, pre-cleaned (EPA protocol B Level II) evacuated glass vials. Each standard has its own designated syringe which is cleaned with ultra-pure nitrogen before the standards are prepared.

7.2 Modified EPA Methods 8010 and 8020

A gas chromatograph equipped with an electron capture detector (GC/ECD), following modified EPA 8010 methodology, is used to identify and quantify chlorinated compounds typically found in industrial solvents, while a flame ionization detector (GC/FID), following a modified EPA 8020 methodology, is used for petroleum and other non-halogenated compounds.

7.3 Reported Quantification Limits

The "Reported Quantification Limit" is a concentration level at which the degree of confidence in the actual presence of a compound becomes meaningful. A reported quantification limit should not be confused with the concentration represented by the smallest detectable chromatogram peak area. The importance of reported quantification limits should also be weighed in the context of acceptable exposure levels and the general levels of contamination on a site. The reported quantification levels for compounds to be identified on the GC/FID (petroleum hydrocarbons) will be 1.0 µg/l. The reported quantification levels for compounds identified on the GC/ECD are 1.0 µg/l.

The following tables list the minimum concentrations (the reported quantification limits) of selected compounds reported using TARGET's soil gas analyses (additional analytes are available).

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10.0 Preventive Maintenance

Maintenance checks are conducted on a daily basis and all information is recorded in the system maintenance book. Daily checks include:

- monitoring purge and flow rates
- checking gas pressure readings to the GC
- ensuring a lit flame for the FID
- checking the sufficient pressure warning light on the autosampler
- conditioning the columns at 200°C
- replacement of the injection septa
- checking the alignment of the syringe body, the injection ports on the GC, and the autosampler

The carrier gases are checked twice daily, on arrival in the morning and on departure in the evening. They are replaced when necessary or if there is a problem with the analysis on the GCs.

Other maintenance checks include: 1) teflon plunger tips on the syringes are replaced at least once a month; 2) the carousel wheel and its mechanisms are adjusted when necessary; 3) columns are replaced as required based on loss of resolving capability or decrease in retention times (all other parameters constant) of more than five minutes; 4) All tubing is replaced when necessary.

TABLE A-1

<u>Parameter</u>	<u>Reported Quantification Limit</u>
<u>Purgeable Halocarbons - Soil Gas Method 8010 ($\mu\text{g/l}$)</u>	
1,1-Dichloroethane	1.0
Dichloromethane	1.0
trans-1,2-Dichloroethene	1.0
1,1-Dichloroethane	1.0
cis-1,2-Dichloroethene	1.0
1,1,1-Trichloroethane	1.0
Carbon Tetrachloride	1.0
Trichloroethene	1.0
1,1,2-Trichloroethane	1.0
Tetrachloroethene	1.0
<u>Aromatic Volatile Organics - Soil Gas Method 8020 ($\mu\text{g/l}$)</u>	
Benzene	1.0
Ethylbenzene	1.0
Toluene	1.0
Xylenes	1.0

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APPENDIX B
SOIL SAMPLING PROCEDURES

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SOIL SAMPLING PROCEDURES

1.0 Introduction

Soil borings will be completed using the Geoprobe or similar type hydraulically-powered soil probing machine to a depth specified by the supervising geologist/engineer. In situations where physical site features limit the use of the Geoprobe rigs, soil borings will be completed with a hand-driven auger, a portable power auger, or a power-driven split-barrel sampler (split-spoon) depending on the required depth and subsurface material.

Samples of subsurface material encountered during the drilling of soil borings will be collected continuously to the required depth of the boring, or as directed by the supervising geologist. The sampling method employed will be as detailed in Attachment B-1.

2.0 Materials

The following materials, as required, shall be available during soil boring sampling:

- Personal protective equipment (as required by the Health & Safety Plan)
- Cleaning equipment (as required in Appendix C)
- All drilling equipment required by the Geoprobe method
- Appropriate sampling containers and forms
- Insulated coolers with ice
- Field notebook
- Aluminum foil
- Flame ionization detector (FID) or photoionization detector (PID) and
- Stainless steel spatula

3.0 Procedures

Soil Borings - Soil samples will be taken to provide a continuous profile of the subsurface. A geologist or engineer will be on site during the drilling operation to fully describe each soil sample including: 1) soil type; 2) color; 3) percent recovery; 4) relative moisture content; 5) texture; 6) particle size and shape; 7) consistency; and 8) any other noteworthy observations. The descriptions will be recorded on a subsurface log (Attachment B-2) or in the field notebook.

Upon retrieval of Geoprobe samples, representative portions of the bottom 3.5-foot depth increment from each sample (unless modified by site-specific conditions), will be placed in appropriate sample containers. One representative portion of each sample will be placed in a Ziplock®-type bag and let stand for several minutes. The head space will then be screened with a flame ionization detector (FID) or

photoionization detector (PID) and the relative concentration of total volatile organic compounds (VOCs) in the sample will be recorded on the boring log, or in the field notebook. For the headspace reading process, glass jars temporarily sealed with aluminum foil may also be used. The headspace screening process is detailed in Appendix D.

Sample containers will be labeled, temporarily stored on site, and transported to the appropriate testing laboratory within the appropriate time frame. The samples will be handled, packed, and shipped in accordance with the procedures set forth in Appendix E.

The supervising geologist or engineer will be responsible for documenting drilling events in the field notebook. The drilling contractor will be responsible for obtaining accurate and representative samples and informing the supervising geologist of changes in drilling pressure.

When sampling is completed, the tailings from the unused portion of the sample will be placed back down the borehole, in accordance with the May 1992 Field Sampling Procedures Manual. Boreholes at or near the water table will include sealing with a non-shrinking impermeable material.

4.0 Survey

Soil borings and soil gas locations will be carefully documented in the field notes using plant references.

5.0 Equipment Cleaning

Equipment cleaning will be performed at the beginning of the sampling event and between each separate sampling location as described in Appendix C.

6.0 Disposal Methods

All water generated during cleaning procedures will be collected and contained on site in sealed, labeled containers.

Personal protective equipment, such as gloves, disposable clothing, and other disposal equipment, resulting from personnel cleaning procedures and from soil sampling and handling activities, will be placed in plastic bags. Based on prior sample results, the level of contaminants in materials that will come in contact with protective clothing is low. Therefore, the plastic bags will be placed in an on-site dumpster for regular non-hazardous waste disposal. If areas of obviously elevated contamination are encountered, the personal protective equipment will be placed in plastic bags. These bags will be transferred into appropriately labeled 55-gallon drums for disposal at an appropriate hazardous waste facility, as necessary.

Soil will be placed back into boreholes in accordance with the May 1992 NJDEP Field Sampling Procedures Manual.

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The objective of this procedure is to collect a soil sample at depth and recover it for visual inspection and/or chemical analysis.

2.0 BACKGROUND

2.1 Definitions

Geoprobe*: A vehicle-mounted, hydraulically-powered soil probing machine that utilizes static force and percussion to advance small diameter sampling tools into the subsurface for collecting soil core, soil gas, or groundwater samples.

** Geoprobe is a registered trademark of Kejr Engineering, Inc., Salina, Kansas*

Macro-Core® Soil Sampler*: A 48-inch long x 2.0-inch diameter (1219 mm x 51 mm) soil sampler capable of recovering a sample that measures up to 1302 ml in volume in the form of a 45-inch x 1.5-inch (1143 mm x 38 mm) core. The Macro-Core® Sampler may be used for open-tube as well as closed-piston sampling.

** Macro-Core® is a registered trademark of Kejr Engineering, Inc., Salina, Kansas*

Liner: A 46-inch long x 1.75-inch diameter (1168 mm x 44 mm) removable/replaceable, thin-walled tube inserted inside the Macro-Core® sampler tube for the purpose of containing and storing soil samples. Liner materials include stainless steel, Teflon®, and clear plastic (PETG).

2.2 Discussion

In this procedure, the assembled Macro-Core Soil Sampler is attached to the leading end of a Geoprobe probe rod and driven into the subsurface using a Geoprobe soil probing machine. Additional probe rods are connected in succession to advance the sampler to depth. The Macro-Core Sampler may be used as an open-tube or closed-piston sampler.

The simplest and most common use of the Macro-Core Sampler is as an open-tube sampler (Fig. 2.1A). In this method, coring starts at the ground surface with an open-ended sampler. From the ground surface, the Macro-Core Sampler is advanced 48 inches (1219 mm) and retrieved from the hole with the first soil core. In stable soils, the open-tube sampler is inserted back down the same hole to obtain the next core. Geoprobe operators have reported coring to depths exceeding 30 feet (9 m) with this method.

In unstable soils which tend to collapse into the core hole, the Macro-Core Sampler can be equipped with a closed-piston point assembly (Fig. 2.1B). This assembly actually locks into the cutting shoe and prevents soil from entering the sampler as it is advanced in the existing hole.

The Macro-Core Closed-Piston Sampler is not designed to be driven through undisturbed soil. Soil is first removed to sampling depth with an open-tube sampler, or a pilot hole may be made with a Macro-Core Pre-Probe. A closed-piston tip is then installed and the sampler is inserted or driven back down the same hole. When the leading end of the sampler reaches the top of the next sampling interval, the piston tip is unlocked using extension rods inserted down the inside of the probe rods.

Once the piston tip is relieved, the sampler is simply driven another 48 inches (1219 mm). Soil entering the sampler pushes the piston assembly to the top of the sample liner where it is retrieved upon removal of the soil core and liner.

Loose soils will sometimes fall out of the Macro-Core Sampler as it is retrieved from depth. The Macro-Core Core Catcher (Fig. 2.1) was designed to alleviate this problem. Excellent results are obtained when the core catcher (sometimes called a basket retainer) is used with saturated sands and other non-cohesive soils. A core catcher is not necessary when sampling tight soils and may actually inhibit sample recovery. Constructed of PETG, the core catcher may be used with PETG, Teflon®, and stainless steel liners.

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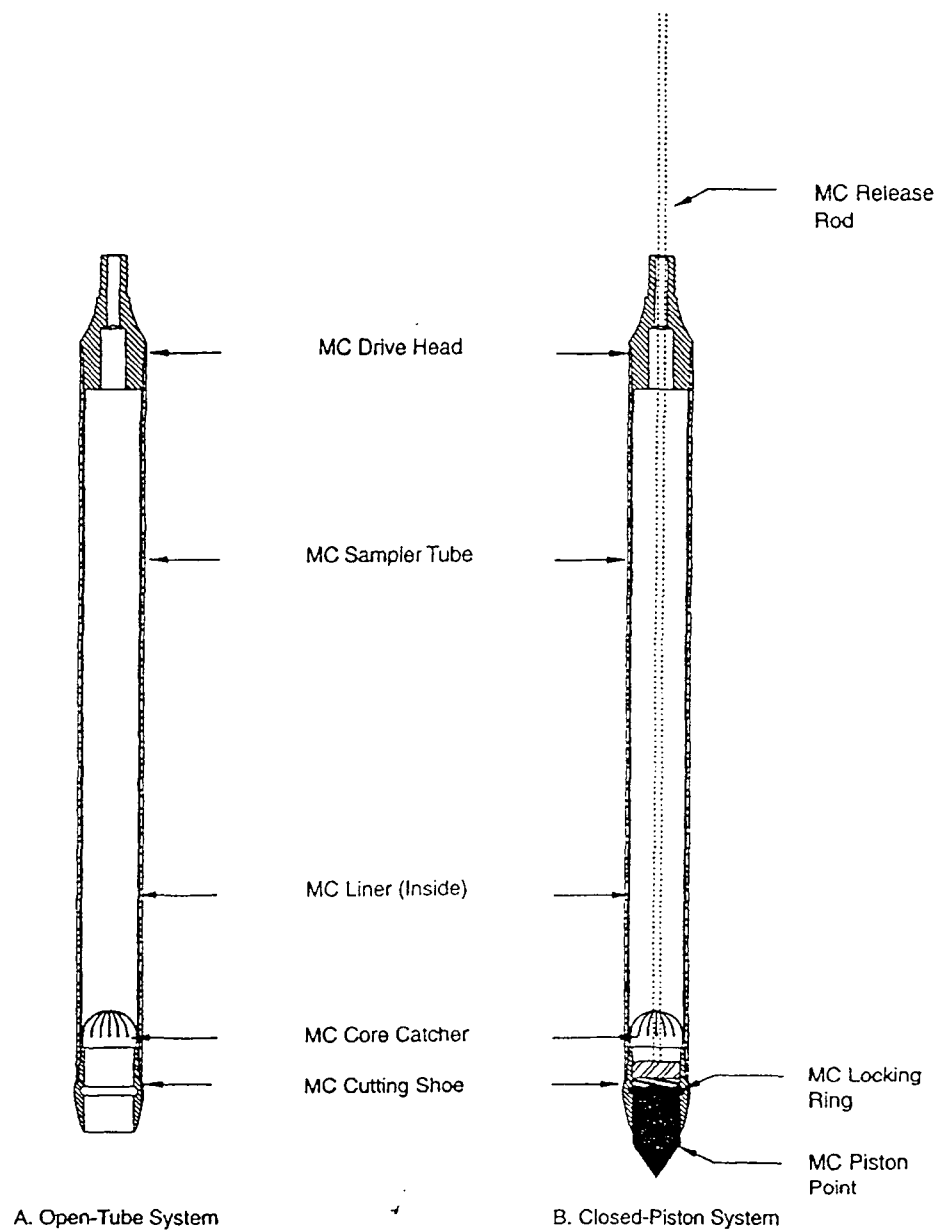


FIGURE 2.1
Macro-Core® Soil Sampler Assemblies

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CLIENT:		LOG OF BORING No.	
PROJECT No.	SITE LOCATION:	THE WHITMAN COMPANIES, INC.	SHEET 1 OF
DRILLING Co. _____ DRILLER _____ DRILLING METHOD _____ HOLE DIA. _____ IN. SAMPLER _____ HAMMER WT. _____ LBS. FALL _____ DATE DRILLED _____ GEOLOGIST _____ TOTAL DEPTH _____ DEPTH AT WATER _____		LOCATION SKETCH (N.T.S.)	

DEPTH (FEET)	SAMPLING DATA				SOIL CLASSIFICATION	REMARKS
	SAMPLE INTERVAL	SAMPLE No.	RECOVERY IN INCHES	BLOWS PER 6"		
—					300659	
1						
—						
2						
—						
3						
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APPENDIX C

FIELD CLEANING/DECONTAMINATION PROCEDURES

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FIELD CLEANING/DECONTAMINATION PROCEDURES

I. Introduction

Equipment cleaning areas will be located within or adjacent to a specific work area. The equipment cleaning procedures described herein include pre-field, in the field, and post-field cleaning of sampling equipment. The sampling equipment consists of soil sampling equipment, well construction materials, ground-water sampling devices, drain sediment sampling devices, water testing instruments, and other activity-specific sampling equipment. The non-disposable equipment will be cleaned after completion of each sampling event. Cleaning procedures will be monitored by the performance of QA/QC checks through sampling and analysis as described in the Quality Assurance Project Plan (QAPP).

II. Materials

The following materials, as required, shall be available during equipment cleaning:

- Personal protection equipment (as required in the Health and Safety Plan);
 - Distilled/deionized water;
 - Non-phosphate soap (Alconox® or equivalent);
 - Tap water;
 - High-pressure water/steam cleaning unit;
 - Wash basins;
 - Brushes;
 - Polyethylene sheeting;
 - Aluminum foil;
 - Plastic overpack drum or garbage can;
 - Large heavy-duty garbage bags;
 - Spray bottles (to hold soapy water, tap water, or distilled/deionized); and
 - Disposable [polyvinyl chloride (PVC) or nitrile] gloves.
- * Nitric Acid and Acetone

III. Storage of Equipment

All decontaminated sampling equipment will be stored in a clean environment and, where appropriate, the equipment will be covered with aluminum foil.

IV. Safety Procedures During Equipment Cleaning

1. Personnel will wear the following personal protection equipment when cleaning smaller sampling equipment (e.g., split-spoon sampler, trowels):
 - Safety glasses, goggles, or a splash shield; and
 - PVC or nitrile outer gloves.

2. Personnel will wear the following additional personal protection equipment when cleaning larger equipment (e.g., drilling rigs) with a high-pressure water/steam cleaning unit:
 - Safety glasses, goggles, or a splash shield;
 - PVC or nitrile outer gloves;
 - Laminated-type Tyvek® disposable coveralls, or rain suit; and
 - Chemically resistant overboots.

V. Field Cleaning Procedures

A. Cleaning Station

Selection of a field equipment cleaning station location will be important. It will be located away from the immediate work area so as not to adversely impact the cleaning procedure, but close enough to the sampling teams to keep equipment handling to a minimum.

A designated area will be established to conduct all cleaning at each work area, as appropriate. All equipment such as drill rigs, or other mobile equipment will receive an initial cleaning prior to use at the site. The frequency of subsequent cleaning while on site will depend on the extent to which the equipment is actually used in relation to the collection of environmental samples.

B. Decontamination of Smaller Sampling Equipment

Cleaning of smaller sampling equipment (e.g., split-spoon samplers, bailers, trowels) will follow the decontamination procedures presented in Table C-1. The first step, a non-phosphate soap and tap water wash, is to remove all visible particulate matter and residual oils and grease. This may be preceded by a steam cleaning to facilitate solids removal. When samples are to be analyzed for organic or inorganic constituents, the soap and tap water wash will be followed by a tap water rinse to remove the detergent and a distilled/deionized water rinse.

C. Decontamination of Submersible Pumps

Submersible pumps may be used to evacuate stagnant ground water in the well casing. The pumps will be cleaned and flushed between uses. This cleaning process will consist of an external detergent wash and tap water rinse, or a steam cleaning of pump casing, hose, and cables followed by a flushing with potable water through the pump. This flushing will be performed with the use of a clean plastic overpack drum or plastic garbage can filled with potable water. The pump will run long enough to flush water sufficiently through the pump housing and hose. Care should be taken to avoid contact with the pump casing and water in the drum while the pump is running to avoid electric shock. The pump and hose will be placed on clean polyethylene sheeting to avoid contact with the ground surface.

D. Decontamination of Heavy Equipment

Other equipment and material associated with sampling events will be cleaned prior to use. Items such as drill rigs, well casings, and auger flights could contain potential sources of interference to environmental samples. The sampling equipment may have come in contact with the materials adjacent to the matrix being sampled or media may be attached to the actual sampling equipment. Heavy equipment may also retain contaminants from other sources such as roadways, storage areas, or material from previous job sites that were not adequately removed. For these reasons, it is important that the sampling equipment be cleaned prior to use during the investigation.

Two methods are used for cleaning heavy equipment: steam cleaning and manual scrubbing. Steam cleaning can remove visible debris. Since steam cleaners provide a high pressure medium, they are very effective for solids removal. They are also easy to handle and generate low volumes of wash solutions.

A second method involves manual scrubbing of equipment using brushes and the procedures detailed in Table C-1. This procedure can be as effective as steam cleaning and is preferred in situations where steam cleaning fails to remove visible materials. Disadvantages to manual scrubbing are that it is labor intensive and it generates large volumes of wash and rinse solutions.

Heavy equipment will be thoroughly steam cleaned or manually scrubbed upon arrival on site and when moved between sampling locations. Drill rig items such as auger flights, drill rods, and drill bits will be cleaned before changing sample locations.

VI. Disposal Methods

All water generated during cleaning procedures will be collected and contained on site in sealed, labeled containers.

Personal protective equipment, such as gloves, disposable clothing, and other disposal equipment, resulting from personnel cleaning procedures and from soil sampling and handling activities, will be placed in plastic bags. Based on prior sample results, the level of contaminants in materials that will come in contact with protective clothing is low. Therefore, the plastic bags will be placed in an on-site dumpster for regular non-hazardous waste disposal. If areas of obviously elevated contamination are encountered, the personal protective equipment will be placed in plastic bags. These bags will be transferred into appropriately labeled 55-gallon drums for disposal at an appropriate hazardous waste facility, as necessary.

TABLE C-1

EQUIPMENT CLEANING

The field sampling equipment cleaning procedures when analyzing for organic constituents are as follows:

1. Non-phosphate soap (Alconox® or equivalent) and tap water wash;
2. Tap water rinse;
3. Acetone*
4. Distilled/deionized water rinse; and
5. Allow to air dry.

* - If visual contamination persists or gross contamination is suspected, the solvent rinse step will be included.

The field sampling equipment cleaning procedures when analyzing for inorganic constituents are as follows:

1. Non-phosphate soap (Alconox® or equivalent) and tap water wash;
2. Nitric acid rinse*;
3. Distilled/deionized water rinse; and
4. Allow to air dry.

* - If visual contamination persists or gross contamination is suspected, the Nitric acid rinse step will be included.

300664

APPENDIX D

**FLAME IONIZATION DETECTOR (FID) OR PHOTOIONIZATION DETECTOR
(PID) FIELD SCREENING PROCEDURES**

300665



FLAME IONIZATION DETECTOR (FID) OR PHOTOIONIZATION DETECTOR (PID) FIELD SCREENING PROCEDURES

I. Introduction

Field screening with a flame ionization detector (FID) or a photoionization detector (PID) is a procedure to measure relative concentrations of volatile organic compounds (VOCs) and other compounds. The characteristics of these instruments are included in their respective operation manuals as are the compounds which they can detect. Field screening will be conducted on the following:

- Work area air to assess exposure to on-site workers of air contaminants via the air pathways;
- Well headspaces as a precautionary measure each time the well cover is opened; and
- Headspace of soil samples to assess the relative concentration of volatile organics in the sample.

II. Materials

The following materials, as required, shall be available while performing FID or PID field screening:

- Personal protective equipment (as required by the Health and Safety Plan);
- Field notebook;
- FID or PID and operating manual;
- Calibration canisters for PID;
- Dräger tubes;
- Hand pump for Dräger tubes;
- Sample containers; and
- Aluminum foil, if glass jars are used.

III. Procedures

PID field instruments will be calibrated and operated to yield "total organic vapor" in ppm (v/v) as benzene. PID operation, maintenance, and calibration shall be performed in accordance with the manufacturer's instructions and entered on the PID calibration and maintenance log (Attachment p -1). FID field instruments will be operated in accordance with the manufacturer's instructions. The FID yields measurements in ppm (v/v) as methane. Below are the general procedures for field screening samples:

1. Don personal protective equipment (as required by the Health and Safety Plan).
2. If so equipped, an alarm can be set at a desired level.

IV. Work Area Air Monitoring Procedures

1. Measure and record the background FID or PID reading.
2. Measure and record breathing space reading.

V. Sample Headspace Screening Procedure

Soil samples will be field screened upon collection with the FID or PID for a relative measure of the total volatile organic concentration. FID or PID readings will be recorded in the field notebook or the boring logs, whichever is appropriate.

1. Fill a Ziplock®-type bag or glass jar with the sample (if sufficient quantities of soil are available) to be analyzed. If a glass jar is used, cover the jar opening with aluminum foil and tighten the jar lid securely;
2. Allow headspace development for at least ten minutes. Vigorously shake the bag for 15 seconds both at the beginning and end of the headspace development period. Where ambient temperatures are below 32°F (0°C), headspace development should be within a heated building;
3. Quickly puncture the bag or foil with the instrument sampling probe. Exercise care to avoid contact with water droplets or soil particles; and
4. Following probe insertion through the bag or foil, record the highest meter response for the sample as the headspace concentration. The maximum response should occur between two and five seconds. Erratic meter response may occur at high organic vapor concentrations or conditions of elevated headspace moisture, in which case headspace data should be recorded and erratic meter response noted.

VI. Equipment Cleaning

After each use, the unit should be wiped with a clean cloth or paper towel.

The UV light source window and ionization chamber should be cleaned in the following manner once a month:

1. With the PID off, disconnect the sensor/probe from the unit.
2. Remove the exhaust screw, grasp the end cap in one hand and the probe shell in the other, and pull apart.
3. Loosen the screws on the top of the end cap, and separate the end cap and ion chamber from the lamp and lamp housing.
4. Tilt the lamp housing with one hand over the opening so that the lamp slides out into your hand.
5. Clean the lamp with lens paper and PID cleaning compound (except 11.7 eV). For the 11.7 eV lamp use a chlorinated organic solvent.
6. Clean the ion chamber using methanol on a Q-tip® and then dry gently at 50°C to 60°C for 30 minutes.
7. Following cleaning, reassemble by first sliding the lamp back into the lamp housing. Place ion chamber on top of the housing, making sure the contacts are properly aligned.
8. Place the end cap on top of the ion chamber and replace the two screws, tighten the screws only enough to seal the o-ring.
9. Line up the pins on the base of the lamp housing with pins inside the probe shell and slide the housing assembly into the shell.

PID/FID CALIBRATION AND MAINTENANCE LOG

INSTRUMENT MANUFACTURER/MODEL _____
 IDENTIFICATION NO.: _____
 LAMP (Circle One) 9.5eV 10.2eV 11.7eV

DATE/ TIME	INITIALS	BATTERY CHECK	CALIBRATION STANDARD			SPAN POT. SETTING	COMMENTS
			SOURCE	TYPE	CONC.		

300668

APPENDIX E
FIELD SAMPLE PACKING, HANDLING AND SHIPPING PROCEDURES

300669



FIELD SAMPLE PACKING, HANDLING, AND SHIPPING PROCEDURES

I. Handling

1. Fill in sample label (Attachment E-1) with:
 - Sample type (e.g., soil, sediment or water);
 - Project number;
 - Sample identification, including site name and sample interval, if applicable;
 - Analysis required;
 - Date;
 - Time sampled;
 - Name, affiliation, and phone number of person preparing label;
 - Mode of collection (composite or grab); and
 - Preservative added, if applicable.
2. Cover the label with clear packing tape to secure the label onto the container.
3. Check the caps on the sample containers so that they are tightly sealed.
4. Mark the level of the sample in the container using an indelible ink marker or grease pencil.
5. Wrap the sample container cap with clear packing tape to prevent it from becoming loose.
6. Place a signed custody seal label (Attachment E-2) over the cap such that the cap cannot be removed without breaking the custody seal.

II. Packing

1. Using duct tape, secure the outside and inside of the drain plug at the bottom of the cooler that is used for sample transport.
2. Place each sample container in individual 2-mil thick (minimum) polyethylene bags (Ziplock®-type) and seal.
3. Place 1 to 2 inches of vermiculite or other cushioning material at the bottom of the cooler.
4. Place the sealed container and bag upright in the cooler.
5. Repackage ice (if required) in small Ziplock®-type plastic bags and place loosely in the cooler. Do not pack ice so tightly that it may prevent addition of sufficient cushioning material.
6. Fill the remaining space in the cooler with vermiculite or other cushioning material.
7. Place the completed chain of custody (COC) forms (Attachment E-3) in a large Ziplock®-type bag and tape the forms to the inside of the cooler lid.
8. Close the lid of the cooler and fasten with duct tape.
9. Wrap strapping tape around both ends of the cooler at least twice.

10. Mark the cooler on the outside with the following information: return address, "Fragile" labels (Attachment E-4) on the top and on one side, and arrows indicating "This Side Up" (Attachment E-4) on two adjacent sides.
11. Place a signed custody seal label (Attachment E-2) over front right and back left of the cooler lid and cover with clear plastic tape.

III. Shipping

1. Environmental samples will be shipped according to 40 CFR 761.65(i)(3).
2. All samples will be delivered by the sampling personnel or by an express carrier, allowing for sufficient time for analysis to be performed within the holding time periods.
3. The following COC procedures will apply to sample shipping:
 - Relinquish the sample containers to the laboratory via personal delivery or express carrier. The signed and dated forms should be taped inside the top of the cooler. The express carrier will not be required to sign the COC forms.
 - When the samples are received by the laboratory, the laboratory personnel shall complete the COC forms by signing and dating to acknowledge receipt of samples. The sample identification numbers on the containers are then checked, so to insure that they are consistent with the COC forms.

THE WHITMAN COMPANIES, INC.
EAST BRUNSWICK, NEW JERSEY 08816

Client:

Date:

Time:

Sample ID#:

Depth:

Sampler:

PRSVE:

Chemical:

CAS #:

300672

4251

CUSTODY SEAL

Person Collecting Sample _____ Sample No. _____
(signature)

Date Collected _____ Time Collected _____

4251

300673

300674

CHAIN-OF-CUSTODY

PROJECTNAME: _____

SITE ADDRESS: _____

PAGE OF

PROJECT NO: _____

SAMPLE DATE: _____

LABORATORY: _____

SAMPLER(S):

[illegible]

ANALYTICAL PARAMETER IDENTIFICATION KEY:

PHI: PETROLEUM HYDROCARBONS
VOC: VOLATILE ORGANICS BY OCMIS WITH LIBRARY SEARCH
PAH: POLYCYCLIC AROMATIC HYDROCARBONS IN BASE NEUTRAL SCAN WITH LIBRARY SEARCH
BN: BASE NEUTRALS WITH LIBRARY SEARCH
AE: ACID EXTRACTABLES WITH LIBRARY SEARCH
PM: PRIORITY POLLUTANT METALS
PP+40: PRIORITY POLLUTANT PLUS FORTY PEAKS

TOTAL NO. CONTAINERS _____

THE
WHITMAN
Companies

44 West Ferris Street
East Brunswick, N.J. 08816
(908) 390-5858
Fax: (908) 390-9496



300675

APPENDIX F

**STANDARD OPERATING PROCEDURES FOR SOIL GAS ANALYSIS BY
MODIFIED EPA METHODS 8010 AND 8020**

300676



TARGET STANDARD OPERATING PROCEDURES (SOP)

SOP	REVISION	DATE
8010	3.0	3/29/96

Reviewed by:	Title	Signature	Date
Brian M. Abraham, Ph.D.	Laboratory Director		3/29/96
Michael Marrale, Jr.	Laboratory Supervisor		3/29/96

STANDARD OPERATING PROCEDURES FOR THE ANALYSIS OF HALOGENATED VOLATILE ORGANICS BY GAS CHROMATOGRAPHY USING USEPA METHODS 3810/8010

1.0 SCOPE AND APPLICATION

- 1.1 Method 8010 is used to determine the concentration of various volatile halogenated organic compounds. The following compounds, with associated method detection limits, can be determined by this method:

Parameter	Synonym	Acronym	CAS No.	Static Headspace MDL (µg/L)		
				soil gas	soil	water
1,1-Dichloroethene	Ethylene Chloride	11DCE	75-35-4	0.188	2.50	1.50
Dichloromethane	Methylene Chloride	MeCl ₂	75-09-2	0.126	2.81	1.73
trans-1,2-Dichloroethene	N/A	t12DCE	156-60-5	0.345	3.17	1.31
1,1-Dichloroethane	Ethylidene Chloride	11DCA	75-34-3	0.345	2.50	2.06
cis-1,2-Dichloroethene	N/A	c12DCE	156-59-2	0.534	2.83	1.77
1,1,1-Trichloroethane	Methyl Chloroform	111TCA	71-55-6	0.025	0.161	0.180
Carbon Tetrachloride	Tetrachloromethane	CT	56-23-5	0.041	0.187	0.230
Trichloroethene	N/A	TCE	79-01-6	0.038	0.188	0.171
1,1,2-Trichloroethane	N/A	112TCA	79-00-5	0.104	0.245	0.112
Tetrachloroethene	Perchloroethene	PCE	127-18-4	0.079	0.181	0.191

- 1.2 The above method detection limits were determined according to EPA 40 CFR Part 136 Appendix B utilizing EPA Method 3810 sample introduction using custom gas-based and methanolic based NIST traceable standards.

2.0 SUMMARY OF METHODS

- 2.1 Method 8010 provides gas chromatographic conditions for the detection of halogenated volatile organic compounds. Samples are introduced into the GC using static heated headspace EPA Method 3810. A temperature program is used in the gas chromatograph to separate the organic compounds. Detection is achieved by using either an electron capture detector (ECD) or an electrolytic conductivity detector (ELCD or Hall).

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3.0 INTERFERENCES

- 3.1 During analysis, major contaminant sources are volatile materials in the laboratory and impurities in the sample and/or standard containers. The use of non-polytetrafluoroethylene (PTFE) plastic tubing, non-PTFE thread sealants, or flow controllers with rubber components in the GC system should be avoided since such materials out-gas organic compounds which will be concentrated in the system during operation. Analyses of laboratory reagent blanks (discussed below) provide information about the presence of contaminants. When potential interfering peaks are noted in laboratory reagent blanks, the analyst should locate and change the affected components in the system.
- 3.2 Cross contamination can occur whenever high level and low level samples are sequentially analyzed. To reduce cross contamination, the GC temperature should be elevated to "bake out" potential contaminants prior to subsequent sample analysis from the inlet, column interface, column and detector regions. Additionally, the sample syringe must be rinsed with organic non matrix interfering solvent and/or reagent water between sample analyses. Whenever an unusually concentrated sample is encountered, it should be followed by a matrix blank analysis to check for cross contamination.
- 3.3 Samples can be contaminated by diffusion of volatile organics (particularly chlorofluorocarbons and methylene chloride) through the sample container septum during shipment and storage. A trip blank prepared from organic-free reagent water and carried through sampling and subsequent storage and handling can serve as a check on such contamination. Additionally, the septa of some vials have been shown to contain carbon disulfide which is detected using this methodology.

4.0 SAFETY

- 4.1 The toxicity or carcinogenicity of each reagent (and standard) used in this method has not been precisely determined; however, each chemical compound should be treated as a potential health hazard. From this viewpoint, exposure to these chemicals must be reduced to the lowest possible level by whatever means available. Additional references to laboratory safety are available and have been identified as follows:
- 4.1.1 "Carcinogens-Working with Carcinogens," Department of Health, Education, and Welfare, public Health Service, Center for Disease Control, National Institute for Occupational Safety and Health. Publication No. 77-206, August 1977.
 - 4.1.2 "OSHA Safety and Health Standards, General Industry," (29 CFR 1910), Occupational Safety and Health Administration, OSHA 2206 (Revised, January 1976).
 - 4.1.3 "Safety in Academic Chemistry Laboratories," American Chemical Society Publication, Committee on Safety, 3rd Edition, 1979.

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5.0 APPARATUS AND MATERIALS

5.1 Gas chromatograph - An analytical system complete with a temperature programmable gas chromatograph (Shimadzu GC14A or equivalent) suitable for automated heated static headspace introduction (Shimadzu HSS-2B or equivalent) and all required accessories including syringes, analytical columns, gases, detector, and strip-chart recorder or hardware to store, interpret, and print chromatograms.

5.1.2 Analytical Column: 30-m bonded methyl phenyl cyanopropyl silicone (0.53 mm i.d. x 3.0 μ m film thickness) Quadrex or equivalent.

5.1.3 Detector - Electron Capture Detector (ECD).

5.2 Sample containers: 40-mL capacity or larger, equipped with a PTFE-faced silicone septum, certified pre-cleaned (I-Chem Service, Newcastle, DE or equivalent) for collection of water and soil samples. No further cleaning is required for storing collected water samples. 30-mL capacity crimp top vials certified pre-cleaned (I-Chem Service, Newcastle, DE or equivalent) for static headspace analysis.

5.3 Ancillary equipment:

5.3.1 Syringes: 5-mL glass Luerlok tip gastight syringe (Hamilton or equivalent).

5.3.2 Micro syringes: 1, 25, 100, 1000 μ L gastight (Hamilton, or equivalent).

5.3.3 Balance: Analytical, capable of accurately weighing 0.0001 g.

5.3.4 Balance: Analytical, capable of accurately weighing 0.01 g.

5.3.5 Crimper for 30 mL vials.

5.3.6 Decrimper for 30 mL vials.

5.3.7 Cooler and ice or refrigerator.

5.3.8 Spare capillary column.

5.3.9 Spare ECD detector.

5.3.10 Inlet septa.

5.3.11 HSS automatic static headspace syringe (800 μ L).

5.3.12 pH meter (optional).

5.3.13 Spare gas line and Swagelok connectors.

5.3.14 Air generator and lines if not using tank supplied air.

5.3.15 Gas or diesel generator for mobile use with power inverter.

5.3.16 Logbooks: sample prep/run log, calibration log, maintenance log.

5.3.17 3.5" blank disks for electronic storage of data.

5.3.18 Spare boards, instrument parts prone to failure (based on experience).

5.3.19 Tool kit including wrenches, screwdrivers, scissors, soldering iron, etc.

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6.0 REAGENTS

- 6.1 Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, it is intended that all reagents shall conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available. Other grades may be used, provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination.
- 6.2 Organic-free reagent water. All references to water in this method refer to organic-free reagent water
- 6.3 Methanol, CH₃OH. Pesticide quality or equivalent. Store away from other solvents.
- 6.4 Stock standards for static headspace soil and water analysis: Stock standard solutions may be prepared from pure standard materials or purchased as certified solutions. Prepare stock standards in methanol using assayed liquids or gases, as appropriate. Because of the toxicity of some of the organohalides, primary dilutions of these materials should be prepared in a hood.
 - 6.4.1 Place about 9.8 mL of methanol in a 10 mL tared ground glass stoppered volumetric flask. Allow the flask to stand, unstoppered, for about 10 minutes until all alcohol-wetted surfaces have dried. Weigh the flask to the nearest 0.0001 g.
 - 6.4.2 Gases: To prepare standards for any compounds that boil below 30°C (e.g. bromomethane, chloroethane, chloromethane, dichlorodifluoromethane, trichlorofluoromethane, vinyl chloride), fill a 5 mL valved gas-tight syringe with the reference standard to the 5.0 mL mark. Lower the needle to 5 mm above the methanol meniscus. Slowly introduce the reference standard above the surface of the liquid. The heavy gas rapidly dissolves in the methanol.
 - 6.4.3 Reweigh, dilute to volume, stopper, and then mix by inverting the flask several times. Calculate the concentration in milligrams per liter (mg/L) from the net gain in weight. When compound purity is assayed to 96% or greater, the weight may be used without correction to calculate the concentration of the stock standard. Commercially prepared stock standards may be used at any concentration of they are certified by the manufacturer or by an independent source.
 - 6.4.4 Transfer the stock standard solution into a bottle with a Teflon lined screw-cap. Store, with minimal headspace, at -10°C to -20°C and protect from light.
 - 6.4.5 Prepare fresh stock standards for gases weekly or sooner if comparison with check standards indicates a problem. Reactive compounds such as 2-chloroethyl vinyl ether may need to be prepared more frequently. All other standards must be replaced after six months. Both gas and liquid standards must be monitored closely by comparison to the initial calibration curve and by comparison to QC check standards. It may be necessary to replace the standards more frequently if either check exceeds a 20% drift.
 - 6.4.6 Optional calibration using a certified gaseous mixture can be accomplished daily utilizing commercially available gaseous analyte mixture of bromomethane, chloromethane, chloroethane, vinyl chloride, dichlorodifluoromethane and trichlorofluoromethane in nitrogen. These mixtures of documented quality are stable for as long as six months without refrigeration. (VOA-CYL III, RESTEK Corporation, Cat. #20194 or equivalent).

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6.4.7 Secondary dilution standards for soil or water static headspace analysis: using stock standard solutions, prepare secondary dilution standards in methanol, as needed, containing the compounds of interest, either singly or mixed together. The secondary dilution standards should be prepared at concentrations such that the calibration standards will bracket the working range of the analytical system. Secondary dilution standards should be stored with minimal headspace for volatiles and should be checked frequently for signs of degradation of evaporation, especially just prior to preparing calibration standards from them. Secondary standards are not needed for soil gas since these standards are directly injected as stock.

6.5 Calibration standards for static headspace soil and water analysis: Static headspace soil and water calibration standards should be derived from the methanolic standards. Five concentration levels should be used spanning the linear range of the GC detector.

6.6 Stock standards for static headspace soil gas analysis: Standards used for static headspace soil gas analysis should be purchased in gaseous form from a certified source (Scott Specialty Gases or equivalent). The stock gas mixture should be purchased in an inert pure gas matrix (i.e., nitrogen) to contain all analytes of interest at sufficiently high concentration to cover the linear working range of the detector upon dilution as needed. The methodology cited herein was developed using Scott Specialty Gases custom blend mixture ALM-009522 with the following compounds and stock concentrations in the mixture and resulting concentrations extrapolated into a standard 800 µL autosampler injection of stock filled into a 30 mL crimp top sample vial:

Parameter	CAS No.	Stock Concentration (ppb)	Extrapolated Concentration (µg/L)
11DCE	75-35-4	2740	12.1
McCl ₂	75-09-2	2040	7.73
112DCE	156-60-5	3180	13.8
11DCA	75-34-3	3170	14.0
112DCE	156-59-2	4090	17.7
111TCA	71-55-6	232	1.38
CT	56-23-5	253	1.74
TCE	79-01-6	228	1.34
112TCA	79-00-5	403	2.40
PCE	127-18-4	233	1.72

The concentrations values used should be the certified analyzed values and not the theoretically derived values. Conversion from parts per billion in the stock tank to µg/L in an 800 µL injection from a 30 mL vial are calculated as follows:

$$\mu\text{g/L} = [\text{ppb}(\text{v/v}) \times \text{MW}(\text{g/mole}) \times 10^6(\mu\text{g/g})] \div [22.4(\text{L/mole}) \times 10^9(\text{ppb})]$$

6.7 Calibration standards for static headspace soil gas: Static headspace soil gas standards should be prepared directly from stock gaseous standards purchased and certified from a reputable vendor (Scott Specialty Gases or equivalent) as shown above. Standard dilutions must not be made in vials by removing volumes of static gas and injecting stock standard. This technique has shown to be ineffective in transferring volumes of stock into the evacuated vial presumably due to density differences between the gas evacuated from the vial and the gaseous stock standard. The result is a consistently decreasing calibration factor over the concentration ranges studied. The purchased and certified stock standard gas mix should be directly injected into the GC system using a gastight syringe at varying

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volumes to create a calibration curve which can be used to assess soil gas collected in 30 mL crimp top vials or Tedlar bags. Recommended volumes of stock directly injected and the resulting concentrations are shown below:

Parameter	Cal. Point 1		Cal. Point 2		Cal. Point 3		Cal. Point 4		Cal. Point 5	
	Vol.	Conc.	Vol.	Conc.	Vol.	Conc.	Vol.	Conc.	Vol.	Conc.
	(μ L)	(μ g/L)	(μ L)	(μ g/L)	(μ L)	(μ g/L)	(μ L)	(μ g/L)	(μ L)	(μ g/L)
11DCE	100	1.51	250	3.78	500	7.55	750	11.3	1000	15.1
McCl ₂	100	0.967	250	2.42	500	4.84	750	7.25	1000	9.67
112DCE	100	1.73	250	4.33	500	8.65	750	13.0	1000	17.3
11DCA	100	1.75	250	4.38	500	8.75	750	13.1	1000	17.5
112DCE	100	2.21	250	5.53	500	11.1	750	16.6	1000	22.1
111TCA	100	0.173	250	0.433	500	0.865	750	1.30	1000	1.73
CT	100	0.218	250	0.545	500	1.09	750	1.64	1000	2.18
TCE	100	0.168	250	0.420	500	0.840	750	1.26	1000	1.68
112TCA	100	0.300	250	0.750	500	1.50	750	2.25	1000	3.00
PCE	100	0.215	250	0.538	500	1.08	750	1.61	1000	2.15

Calibration standard volumes should be withdrawn directly from a Tedlar bag which has been filled with the stock gas standard. The Tedlar bag should be evacuated and refilled regularly upon signs of degradation of the analytes or poor calibration verification response. Dilution values are based upon standard autosampler injection volumes of samples at 800 μ L. Therefore, calibration point one concentrations are calculated as follows:

$$\text{Point one concentration } (\mu\text{g/L}) = (100 \mu\text{L} \div 800 \mu\text{L}) \times \text{stock concentration } (\mu\text{g/L})$$

If sample dilutions are required by altering the injection volume, resulting concentrations must be multiplied by the magnitude of the dilution. For example, if a sample is analyzed at an 800 μ L injection volume and found to saturate the detector, and a second more dilute injection volume at 100 μ L is used to bring the signal into the linear range of the detector, the quantitated concentration must be multiplied by a factor of 8 (800 μ L \div 100 μ L) to ascertain the actual analyte concentration in the sample. Additionally, dilutions can be performed from the source by using a second soil gas vial and diluting the original sample prior to injection. For soil and water headspace, smaller amounts of soil and lower volumes of water sample can be used similarly to dilute the sample matrix from the source.

7.0 SAMPLE COLLECTION, PRESERVATION, AND HANDLING

- 7.1 For information regarding sample collection, preservation, and handling, refer to Keith, Lawrence H., "Principles of Environmental Sampling", American Chemical Society, 1988.

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8.0 PROCEDURE

8.1 Volatile compounds are introduced into the gas chromatograph using static headspace of soil, water, or soil gas according to EPA Method 3810.

8.2 Gas chromatographic conditions:

Helium flow rate = 50 mL/min, 15 mL/min through column

GC temperature program:

Initial temperature: 35°C, hold for 2 minutes

Program 1: 35°C to 115°C at 10°C/min

Program 2 soil gas: 115°C to 145°C at 40°C/min

Program 2 soil and water: 115°C to 200°C at 40°C/min

Static Headspace Equilibration Program

Soil Gas Temperature: 60°C for 4 minutes

Soil and Water Temperature: 90°C for 10 minutes

8.3 Calibration. The following describes the procedures for calibrating the GC for static headspace soil, water, and soil gas analysis. Suggested resulting concentrations for the initial calibration curve are listed above. Since each GC system is slightly different, alterations to these values may be required to ensure that the low level standard is sufficiently higher than the noise level near but above the method detection limit and the high standard is not in the saturation zone of the detector.

8.3.1 Calibrate the GC for static headspace soil gas analysis by hand-injecting the volumes of stock gas standard shown above into the system.

8.3.2 Calibrate the GC for static headspace water analysis by injecting liquid calibration standards into 15 mL of analyte free water in the 30 mL autosampler vial and crimp seal. Transfer the calibration standard to the water matrix using a gastight syringe and crimp seal immediately. Analyze the resulting sealed standards by autosampler.

8.3.3 Calibrate the GC for static headspace soil analysis by injecting liquid calibration standards into 5 g of analyte free soil matrix (Ottawa Beach Sand or equivalent) in a 30 mL autosampler vial and crimp seal. Transfer the calibration standard to the soil matrix using a gastight syringe and crimp seal immediately. Analyze the resulting sealed standards by autosampler.

8.4 Gas chromatographic analysis: introduce volatile compounds into the gas chromatograph using static headspace EPA Method 3810 by autosampler or hand inject following heating block volatilization.

8.4.1 Table 1 summarizes the estimated retention times of the organic compounds analyzed using this method.

8.4.2 If the response for a peak is off-scale, i.e., beyond the calibration range of the standards, prepare a dilution of the sample and re-analyze or analyze a one point calibration standard above the signal magnitude of the sample response to ensure the calibration factor is in linearity at this level.

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9.0 QUALITY CONTROL

9.1 Each laboratory that uses this method is required to operate a formal quality control program. The minimum requirements of this program consist of an initial demonstration of laboratory capability and an ongoing analysis of spiked samples to evaluate and document data quality. The laboratory must maintain records to document the quality of data that is generated. On-going data quality checks are compared with established performance criteria to determine if the results of analyses meet the performance characteristics of the method. When results of sample spikes indicate a typical method performance. A quality control check standard must be analyzed to confirm that the measurements were performed in an in-control mode of operation.

9.1.1 The analyst must make an initial, one-time, demonstration of the ability to generate acceptable accuracy and precision with this method. This ability is established by analyzing a blind PE sample while being overseen by the laboratory director. Results of the blind PE sample must agree within specified EPA limits.

9.1.2 In recognition of advances that are occurring in chromatography, the analyst is permitted certain options to improve the separations or lower the cost of measurements. Each time such a modification is made to the method, the analyst is required to repeat the demonstration of ability PE sample analysis.

9.2 Calibration Factor (CF) Calculations: Before analyzing samples or mobilizing the GC unit to the field, the analyst must prepare calibration standards at a minimum of five concentrations levels for each compound as previously discussed. As stated, one of the calibration standards should be at a concentration near, but above, the MDL. The other concentrations should correspond to the expected range of concentrations found in the "real-world" sample or the establishment of the GC dynamic range. Quality control ranges for the CFs are discussed below.

9.3 Prior to any calibration curve standard analyses, a method blank analysis must be performed where the system is checked for background contamination. Using analyte free materials (water, soil, or inert gas) analyze a blank sample using the method GC temperature program for the presence/absence of background contaminants in either a soil, water, or gaseous matrix. Blank analyses are also performed at a rate of 10% or one/day.

9.3.1 Corrective Action: If background contamination is found, a process of elimination approach must be taken to isolate the source of the contamination. This process of elimination should include the GC column, GC inlet, injection syringe, injection syringe plunger, sample container cap, sample container, and analyte free matrix in that order. Prior to any analyses (calibration or site samples) the system must be found to be free of any outside sources of contamination.

9.4 Calibration factor measurement: Analyze the five calibration standards and calculate the calibration factor at for each compound at each concentration using the following equation:

$$CF = (A_x)/(C_x) \text{ where,}$$

A_x = area of the analyte peak

C_x = concentration of the standard target analyte

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If the CF value is constant (i.e., $\leq 30\%$ relative standard deviation, RSD) and the correlation coefficient is near 1 (≥ 0.990) over the dynamic range, the CF can be assumed to be invariant and the average of the CF value(s) can be used for quantitation. Percent relative standard deviation is measured as follows:

$$\%RSD = (\sigma/x) \times 100 \text{ where,}$$

σ = the standard deviation of the distribution

x = the average value of the measurements

9.4.1 Corrective Action: The average CF values must be within 30% RSD and correlation coefficient ≥ 0.990 prior to any sample analyses. If the average CF values for any analyte falls outside of the 30% RSD window, the instrument must be checked for proper flow rates, syringe penetration, heating of the headspace vials, and detector condition prior to analyzing the point or points skewing the curve.

9.5 The working calibration curve must be verified each working day (at the beginning and end of each day) by measurement of the analyte calibration factor at the mid-point of the initial calibration curve if the sample analysis concentrations are completely unknown. If the expected sample concentrations are known to be low or high, the CF should be checked at the second or fourth concentrations, respectively. If the CF is within 30% difference from the average CF from the initial five point calibration curve, the instrument is shown to be in calibration. Therefore, it is not necessary to generate a new five point calibration curve on a daily basis. It is recommended that a new five point curve be generated on a monthly basis as a preventative maintenance diagnostic tool. Calibration factor values differing by more than 30% difference for the low and/or high calibration points from the initial calibration curve indicates the integrity of the standard solution has been compromised or the operating parameters of the instrument have changed over time or preventative maintenance must be performed on the GC and/or detector.

9.5.1 Corrective Action: If the calibration factor for any compound varies from the initial calibration curve calibration factor by more than $\pm 30\%$, the test must be repeated using a fresh calibration standard at a second concentration. If any of the analyte CFs calculated from this second point fall outside of the 30% window, a new five point calibration curve must be established. The two previous points can be used as part of this calibration curve if the CFs are consistent. If the new calibration curve CFs do not yield the above stated results, the instrument must be checked for proper flow rates, syringe penetration, heating of the headspace vials, and detector condition and the experiment must be repeated.

9.6 Duplicate analysis is performed at a rate of 5% or one/day. When possible, the duplicate is chosen which was found to contain target analyte. In such cases, it is preferable (time permitting) to perform triplicate analysis and establish measurement precision criteria. Triplicate analysis measurements must result in a 30% RSD. Duplicate analysis should result in a 30% RPD where RPD is measured as:

$$RPD = (\delta/y) \times 100 \text{ where,}$$

δ = the absolute value of the difference between the duplicate measurements.

y = the mean of the two measurements.

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9.6.1 Corrective Action: If either duplicate or triplicate analysis criteria fails, the instrument must be checked for proper flow rates, syringe penetration, heating of the headspace vials, and detector condition and the experiment must be repeated unless the analyte results are sufficiently close (3x) to the method detection limit for that analyte.

9.7 The analyst should monitor both the performance of the analytical system and the effectiveness of the method in dealing with each sample matrix by spiking each sample, standard, and reagent water blank with surrogate compounds recommended to encompass the range of the temperature program used in this method. Prepare the surrogate spike at a concentration at the midpoint of the linear range of the instrument for the analyte selected. For the set of compounds listed above, an appropriate surrogate compound would be 1,2-dichloroethane- d_4 . Recovery limits for the surrogate have been established by the EPA in Method 8000. Laboratory specific values should be generated after analyzing 20 samples of the given matrix with the surrogate compound injected. Warning and control levels are calculated as follows:

Upper Warning Level: $\rho + 2\sigma$

Lower Warning Level: $\rho - 2\sigma$

Upper Control Level: $\rho + 3\sigma$

Lower Control Level: $\rho - 3\sigma$, where

ρ = the average quantitated concentration of the 20 analyses

σ = the standard deviation of the 20 analyses

9.7.1 Corrective Action: If the surrogate fails, the instrument must be checked for proper flow rates, syringe penetration, heating of the headspace vials, and detector condition and the experiment must be repeated. Samples with surrogate recoveries outside of the EPA or laboratory derived limits must be re-analyzed or flagged as estimated on the final data reporting sheet using an H (high) or L (low) flag.

9.8 Static headspace preparation and analysis: For water samples, calibration and QC procedures must be performed using methanol based standards spiked into 15 mL analyte free water blanks. For sample analysis, 15 mL of water sample is syringe transferred from the 40 mL VOA vial into the 30 mL sample analysis crimp top vial and crimp sealed. The water sample injection volumes should be sufficient to ensure proper detection at the experimentally determined MDL's (i.e., 800 μ L). Surrogates should be added as needed. It may be necessary to centrifuge the 40 mL VOA prior to withdrawing the sample aliquot to avoid introduction of suspended solids into the sample analysis vial.

For soil samples, calibration and QC procedures must be performed using methanol based standards spiked into 5 g analyte free soil blanks in a 30 mL sample analysis crimp top vial. For sample analysis, 5 g of soil sample is quickly transferred from the sample container into the sample analysis crimp top vial and crimp sealed. The sample soil quantity should be sufficient to ensure proper detection at the experimentally determined MDL's. Surrogates should be added as needed.

For soil gas samples, all QC procedures must be performed by direct injection of gaseous standards when using either direct injection or autosampling of samples as previously discussed. The sample should be directly injected from the collection container (either Tedlar bags or 30 mL crimp top vials) whenever possible. Injection volumes should be sufficient to ensure proper detection at the experimentally determined MDL's (i.e., 800 μ L).

- 9.9 For sample analysis results, identify the analytes in the sample by comparing the retention times of the peaks in the sample chromatogram with those of the peaks in the standard chromatograms. The width of the retention time window used to make identifications should be based upon measurements of actual retention time variations of standards over the course of a day. Three times the standard deviation of the retention time window is used as a guideline, however, the experience of the analyst should weigh heavily in the interpretation of the chromatograms.
- 9.10 Additional QC implemented will include field duplicates and field blanks when available. When doubt exists over the identification of a peak on the chromatogram, confirmation techniques such as gas chromatography with a dissimilar column, specific element detector, or mass spectral analysis should be implemented.

10.0 CALCULATIONS

- 10.1 Determine the concentration of individual compounds in the sample by using calibration factors (CFs) as follows:

$$\text{Concentration } (\mu\text{g/L}) = A_x/C_f \text{ where,}$$

A_x = area of the analyte peak

C_f = calibration factor as previously defined

- 10.2 Report results in $\mu\text{g/L}$ without correction for surrogate recovery data. All QC data obtained should be reported with the sample results unless otherwise requested by the client. All results, run logs, maintenance logs, calibration results, notes, chromatograms, and electronic data should be filed for easy access and future reference. Final client reports must be prepared and sent to the client the same day or next morning. One copy of the final report should be filed with all previously mentioned data and a second report should be given to the laboratory director to answer any client questions in the event the analyst is not available.

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Table 1. Calibration curves, calibration factors, and %RSD for EPA Method 3810 static headspace sample introduction and EPA Method 8010 analysis of halogenated volatile organics by gas chromatography.

Soil Gas Analysis											
	Stock Conc. ($\mu\text{g/L}$)	Cal. Point 1 ($\mu\text{g/L}$)	Cal. Point 2 ($\mu\text{g/L}$)	Cal. Point 3 ($\mu\text{g/L}$)	Cal. Point 4 ($\mu\text{g/L}$)	Cal. Point 5 ($\mu\text{g/L}$)	Cal. Factor (ave.)	Cal. Factor (%RSD)	Ave. R_t (min.)	R_t (\pm)	r^2
11DCE	12.1	1.61	4.03	7.26	11.3	15.1	5.71	18	1.86	0.30	0.997
MeCl ₂	7.73	1.03	2.58	4.64	7.25	9.66	1.15	11	2.27	0.30	0.995
112DCE	13.7	1.84	4.59	8.26	12.9	17.2	0.550	2.7	2.56	0.30	0.998
11DCA	14.0	1.87	4.67	8.40	13.1	17.5	0.609	26	2.93	0.30	0.999
c12DCE	17.7	2.36	5.90	10.6	16.6	22.1	0.308	3.5	3.53	0.30	0.997
111TCA	1.38	0.184	0.460	0.83	1.29	1.73	150	11	4.68	0.30	0.996
CT	1.74	0.232	0.580	1.04	1.63	2.18	1580	9.0	4.32	0.30	0.996
TCE	1.34	0.179	0.447	0.804	1.26	1.68	58.9	4.3	5.27	0.30	0.997
112TCA	2.40	0.319	0.799	1.44	2.25	3.00	6.98	3.6	7.39	0.30	0.997
PCE	1.72	0.229	0.573	1.03	1.61	2.15	152	5.1	7.67	0.30	0.996
Soil Headspace Analysis											
11DCE		7.13	19.0	28.5	38.0	47.5	1.15	21	1.86	0.30	0.999
MeCl ₂		7.94	21.2	31.7	42.3	52.9	0.207	23	2.27	0.30	0.990
112DCE		7.77	20.7	31.1	41.5	51.8	0.113	14	2.56	0.30	0.998
11DCA		7.77	20.7	31.1	41.5	51.8	0.091	21	2.93	0.30	0.990
c12DCE		7.77	20.7	31.1	41.5	51.8	0.058	9.7	3.53	0.30	0.999
111TCA		0.721	1.92	2.88	3.84	4.80	23.5	17	4.68	0.30	0.998
CT		0.819	2.18	3.28	4.37	5.46	64.3	14	4.32	0.30	0.998
TCE		0.786	2.10	3.14	4.19	5.24	12.2	17	5.27	0.30	0.998
112TCA		0.786	2.10	3.14	4.19	5.24	1.77	9.1	7.39	0.30	0.998
PCE		0.786	2.10	3.14	4.19	5.24	45.1	18	7.67	0.30	0.998
Water Headspace Analysis											
11DCE		2.38	4.75	9.50	14.3	19.0	7810	15	1.86	0.30	0.998
MeCl ₂		2.65	5.29	10.6	15.9	21.2	566	11	2.27	0.30	0.994
112DCE		2.59	5.18	10.4	15.6	20.7	591	3.9	2.56	0.30	0.998
11DCA		2.59	5.18	10.4	15.6	20.7	250	9.4	2.93	0.30	0.992
c12DCE		2.59	5.18	10.4	15.6	20.7	251	8.7	3.53	0.30	0.998
111TCA		0.240	0.480	0.961	1.44	1.92	154000	14	4.68	0.30	0.998
CT		0.279	0.546	1.09	1.64	2.18	443000	14	4.32	0.30	0.997
TCE		0.262	0.524	1.05	1.57	2.10	66600	6.9	5.27	0.30	0.998
112TCA		0.262	0.524	1.05	1.57	2.10	3570	15	7.39	0.30	0.995
PCE		0.262	0.524	1.05	1.57	2.10	287000	13	7.67	0.30	0.998

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TARGET STANDARD OPERATING PROCEDURES (SOP)

SOP	REVISION	DATE
8020	3.0	3/29/96

Reviewed by:	Title	Signature	Date
Brian M. Abraham, Ph.D.	Laboratory Director		3/29/96
Michael Marrale, Jr.	Laboratory Supervisor		3/29/96

STANDARD OPERATING PROCEDURES FOR THE ANALYSIS OF AROMATIC VOLATILE ORGANICS BY GAS CHROMATOGRAPHY USING USEPA METHODS 3810/8020

1.0 SCOPE AND APPLICATION

- 1.1 Method 8020 is used to determine the concentration of various volatile aromatic organic compounds. The following compounds, with associated method detection limits, can be determined by this method:

Parameter	Synonym	Acronym	CAS No.	boiling point (°C)	density- σ (g/cm ³)	Static Headspace MDL (µg/L)		
						soil gas	soil	water
Benzene	N/A	Benz.	71-43-2	80	0.874	1.00	4.36	3.31
Ethylbenzene	N/A	EB	100-41-4	136	0.867	1.00	8.35	2.22
Toluene	Methyl Benzene	Tol	108-88-3	110.6	0.865	1.00	8.47	5.64
<i>m</i> -Xylene	1,3-Dimethyl Benzene	<i>m</i> -X	108-38-3	138-139	0.868	1.00	2.34	3.57
<i>p</i> -Xylene	1,4-Dimethyl Benzene	<i>p</i> -X	106-42-3	138	0.866	*	*	*
<i>o</i> -Xylene	1,2-Dimethyl Benzene	<i>o</i> -X	95-47-6	143-145	0.870	1.00	2.04	4.52

- 1.2 The above method detection limits were determined according to EPA 40 CFR Part 136 Appendix B utilizing EPA Method 3810 sample introduction using custom gas-based and methanolic based NIST traceable standards.

- 1.3 Note: *m* and *p*-Xylenes co-elute and are therefore reported as the sum of the two isomeric pairs.

2.0 SUMMARY OF METHODS

- 2.1 Method 8020 provides gas chromatographic conditions for the detection of aromatic volatile organic compounds. Samples are introduced into the GC using static heated headspace EPA Method 3810. A temperature program is used in the gas chromatograph to separate the organic compounds. Detection is achieved by using a flame ionization detector (FID) or photoionization detector (PID).

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3.0 INTERFERENCES

- 3.1 During analysis, major contaminant sources are volatile materials in the laboratory and impurities in the sample and/or standard containers. The use of non-polytetrafluoroethylene (PTFE) plastic tubing, non-PTFE thread sealants, or flow controllers with rubber components in the GC system should be avoided since such materials out-gas organic compounds which will be concentrated in the system during operation. Analyses of laboratory reagent blanks (discussed below) provide information about the presence of contaminants. When potential interfering peaks are noted in laboratory reagent blanks, the analyst should locate and change the affected components in the system.
- 3.2 Cross contamination can occur whenever high level and low level samples are sequentially analyzed. To reduce cross contamination, the GC temperature should be elevated to "bake out" potential contaminants prior to subsequent sample analysis from the inlet, column interface, column and detector regions. Additionally, the sample syringe must be rinsed with organic non matrix interfering solvent and/or reagent water between sample analyses. Whenever an unusually concentrated sample is encountered, it should be followed by a matrix blank analysis to check for cross contamination.
- 3.3 Samples can be contaminated by diffusion of volatile organics (particularly chlorofluorocarbons and methylene chloride) through the sample container septum during shipment and storage. A trip blank prepared from organic-free reagent water and carried through sampling and subsequent storage and handling can serve as a check on such contamination. Additionally, the septa of some vials have been shown to contain carbon disulfide which is detected using this methodology.

4.0 SAFETY

- 4.1 The toxicity or carcinogenicity of each reagent (and standard) used in this method has not been precisely determined; however, each chemical compound should be treated as a potential health hazard. From this viewpoint, exposure to these chemicals must be reduced to the lowest possible level by whatever means available. Additional references to laboratory safety are available and have been identified as follows:
 - 4.1.1 "Carcinogens-Working with Carcinogens," Department of Health, Education, and Welfare, public Health Service, Center for Disease Control, National Institute for Occupational Safety and Health. Publication No. 77-206, August 1977.
 - 4.1.2 "OSHA Safety and Health Standards, General Industry," (29 CFR 1910), Occupational Safety and Health Administration, OSHA 2206 (Revised, January 1976).
 - 4.1.3 "Safety in Academic Chemistry Laboratories," American Chemical Society Publication, Committee on Safety, 3rd Edition, 1979.

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5.0 APPARATUS AND MATERIALS

- 5.1 Gas chromatograph - An analytical system complete with a temperature programmable gas chromatograph (Shimadzu GC14A or equivalent) suitable for automated heated static headspace introduction (Shimadzu HSS-2B or equivalent) and all required accessories including syringes, analytical columns, gases, detector, and strip-chart recorder or hardware to store, interpret, and print chromatograms.
 - 5.1.2 Analytical Column: 30-m bonded nonpolar poly(dimethylsiloxane) (0.53 mm i.d. x 1.5 µm film thickness) Supelco SPB-1 or equivalent.
 - 5.1.3 Detector: Flame ionization detector (FID).
- 5.2 Sample containers: 40-mL capacity or larger, equipped with a PTFE-faced silicone septum, certified pre-cleaned (I-Chem Service, Newcastle, DE or equivalent) for collection of water and soil samples. No further cleaning is required for storing collected water samples. 30-mL capacity crimp top vials certified pre-cleaned (I-Chem Service, Newcastle, DE or equivalent) for static headspace analysis.
- 5.3 Ancillary equipment:
 - 5.3.1 Syringes: 5-mL glass Luerlok tip gastight syringe (Hamilton or equivalent) for purge and trap.
 - 5.3.2 Micro syringes: 1, 25, 100, 1000 µL gastight (Hamilton, or equivalent).
 - 5.3.3 Balance: Analytical, capable of accurately weighing 0.0001 g.
 - 5.3.4 Balance: Analytical, capable of accurately weighing 0.01g.
 - 5.3.5 Crimper for 30 mL vials.
 - 5.3.6 Decrimper for 30 mL vials.
 - 5.3.7 Cooler and ice or refrigerator.
 - 5.3.8 Spare capillary column.
 - 5.3.9 Spare ECD detector.
 - 5.3.10 Inlet septa.
 - 5.3.11 HSS automatic static headspace syringe (800 µL).
 - 5.3.12 pH meter (optional).
 - 5.3.13 Spare gas line and Swagelok connectors.
 - 5.3.14 Air generator and lines if not using tank supplied air.
 - 5.3.15 Gas or diesel generator for mobile use with power inverter.
 - 5.3.16 Logbooks: sample prep/run log, calibration log, maintenance log.
 - 5.3.17 3.5" blank disks for electronic storage of data.
 - 5.3.18 Spare boards, instrument parts prone to failure (based on experience).
 - 5.3.19 Tool kit including wrenches, screwdrivers, scissors, soldering iron, etc.

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6.0 REAGENTS

- 6.1 Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, it is intended that all reagents shall conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available. Other grades may be used, provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination.
- 6.2 Organic-free reagent water. All references to water in this method refer to organic-free reagent water.
- 6.3 Methanol, CH_3OH . Pesticide quality or equivalent. Store away from other solvents.
- 6.4 Stock standards for static headspace soil and water analysis: Stock standard solutions may be prepared from pure standard materials or purchased as certified solutions. Prepare stock standards in methanol using assayed liquids or gases, as appropriate. Because of the toxicity of some of the analytes, primary dilutions of these materials should be prepared in a hood.
- 6.4.1 Place about 9.8 mL of methanol in a 10 mL tared ground glass stoppered volumetric flask. Allow the flask to stand, unstoppered, for about 10 minutes until all alcohol-wetted surfaces have dried. Weigh the flask to the nearest 0.0001 g.
- 6.4.2 Reweigh, dilute to volume, stopper, and then mix by inverting the flask several times. Calculate the concentration in milligrams per liter (mg/L) from the net gain in weight. When compound purity is assayed to 96% or greater, the weight may be used without correction to calculate the concentration of the stock standard. Commercially prepared stock standards may be used at any concentration if they are certified by the manufacturer or by an independent source.
- 6.4.3 Transfer the stock standard solution into a bottle with a Teflon lined screw-cap. Store, with minimal headspace, at -10°C to -20°C and protect from light.
- 6.4.4 Replace standards after six months or as needed. Both gas and liquid standards must be monitored closely by comparison to the initial calibration curve and by comparison to QC check standards. It may be necessary to replace the standards more frequently if either check exceeds a 30% drift.
- 6.5 Secondary dilution standards for soil or water static headspace analysis: using stock standard solutions, prepare secondary dilution standards in methanol, as needed, containing the compounds of interest, either singly or mixed together. The secondary dilution standards should be prepared at concentrations such that the calibration standards will bracket the working range of the analytical system. Secondary dilution standards should be stored with minimal headspace for volatiles and should be checked frequently for signs of degradation or evaporation, especially just prior to preparing calibration standards from them. Secondary standards are not needed for soil gas since these standards are directly injected as stock.
- 6.6 Calibration standards for static headspace soil and water analysis: Static headspace soil and water calibration standards should be derived from the methanolic standards. Five concentration levels should be used spanning the linear range of the GC detector.

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- 6.7 Stock standards for static headspace soil gas analysis: Standards used for static headspace soil gas analysis should be purchased in gaseous form from a certified source (Scott Specialty Gases or equivalent). The stock gas mixture should be purchased in an inert pure gas matrix (i.e., nitrogen) to contain all analytes of interest at sufficiently high concentration to cover the linear working range of the detector upon dilution as needed. The methodology cited herein was developed using Scott Specialty Gases custom blend mixture with the following compounds and stock concentrations in the mixture and resulting concentrations extrapolated into a standard 800 µL autosampler injection of stock filled into a 30 mL crimp top sample vial:

Parameter	CAS No.	Stock Concentration (ppb)	Extrapolated Concentration (µg/L)
Benz	71-43-2	100,000	349
EB	100-41-4	95,700	454
Tol	108-88-3	100,000	411
m-X	108-38-3	99,800	473
p-X	106-42-3	99,400	471
o-X	95-47-6	97,100	460

The concentrations values used should be the certified analyzed values and not the theoretically derived values. Conversion from parts per billion in the stock tank to µg/L in an 800 µL injection from a 30 mL vial are calculated as follows:

$$\mu\text{g/L} = [\text{ppb}(\text{v/v}) \times \text{MW}(\text{g/mole}) \times 10^6(\mu\text{g/g})] \div [22.4(\text{L/mole}) \times 10^9(\text{ppb})]$$

- 6.8 Calibration standards for static headspace soil gas: Static headspace soil gas standards should be prepared directly from stock gaseous standards purchased and certified from a reputable vendor (Scott Specialty Gases or equivalent) as shown above. Standard dilutions must not be made in vials by removing volumes of static gas and injecting stock standard. This technique has shown to be ineffective in transferring volumes of stock into the evacuated vial presumably due to density differences between the gas evacuated from the vial and the gaseous stock standard. The result is a consistently decreasing calibration factor over the concentration ranges studied. Stock standard gas mix should be directly injected into the GC system using a gastight syringe at varying volumes to create a calibration curve which can be used to assess soil gas collected in 30 mL crimp top vials or Tedlar bags. Recommended volumes of stock directly injected and the resulting concentrations are shown below:

Parameter	Cal. Point 1		Cal. Point 2		Cal. Point 3		Cal. Point 4		Cal. Point 5	
	Vol. (µL)	Conc. (µg/L)	Vol. (µL)	Conc. (µg/L)	Vol. (µL)	Conc. (µg/L)	Vol. (µL)	Conc. (µg/L)	Vol. (µL)	Conc. (µg/L)
Benz	10	0.436	2500	109	5000	218	7500	327	10000	436
EB	10	0.567	2500	142	5000	283	7500	425	10000	567
Tol	10	0.514	2500	129	5000	257	7500	386	10000	514
m-X	10	0.591	2500	148	5000	296	7500	443	10000	591
p-X	10	0.575	2500	144	5000	288	7500	431	10000	575
o-X	10	0.589	2500	147	5000	294	7500	442	10000	589

Calibration standard volumes should be withdrawn directly from a Tedlar bag which has been filled with the stock gas standard. The Tedlar bag should be evacuated and refilled regularly upon signs of degradation of the analytes or poor calibration verification response. Dilution values are based upon standard autosampler injection volumes of samples at 800 μ L. Therefore, calibration point one concentrations are calculated as follows:

$$\text{Point one concentration } (\mu\text{g/L}) = (100 \mu\text{L} \div 800 \mu\text{L}) \times \text{stock concentration } (\mu\text{g/L})$$

If sample dilutions are required by altering the injection volume, resulting concentrations must be multiplied by the magnitude of the dilution. For example, if a sample is analyzed at an 800 μ L injection volume and found to saturate the detector, and a second more dilute injection volume at 100 μ L is used to bring the signal into the linear range of the detector, the quantitated concentration must be multiplied by a factor of 8 ($800 \mu\text{L} \div 100 \mu\text{L}$) to ascertain the actual analyte concentration in the sample. Additionally, dilutions can be performed from the source by using a second soil gas vial and diluting the original sample prior to injection. For soil and water headspace, smaller amounts of soil and lower volumes of water sample can be used similarly to dilute the sample matrix from the source.

7.0 SAMPLE COLLECTION, PRESERVATION, AND HANDLING

- 7.1 For information regarding sample collection, preservation, and handling, refer to Keith, Lawrence H., "Principles of Environmental Sampling", American Chemical Society, 1988.

300694

8.0 PROCEDURE

8.1 Volatile compounds are introduced into the gas chromatograph using static headspace of soil, water, or soil gas according to EPA Method 3810.

8.2 Gas chromatographic conditions:

Helium flow rate = 50 mL/min, 10-15 mL/min through column

GC temperature program:

Initial temperature: 35°C, hold for 2 minutes

Program 1: 35°C to 115°C at 10°C/min

Program 2 soil gas: 115°C to 145°C at 40°C/min

Program 2 soil and water: 115°C to 200°C at 40°C/min

Static Headspace Equilibration Program

Soil Gas Temperature: 60°C for 4 minutes

Soil and Water Temperature: 90°C for 10 minutes

8.3 Calibration. The following describes the procedures for calibrating the GC for static headspace soil, water, and soil gas analysis. Suggested resulting concentrations for the initial calibration curve are listed above. Since each GC system is slightly different, alterations to these values may be required to ensure that the low level standard is sufficiently higher than the noise level near but above the method detection limit and the high standard is not in the saturation zone of the detector.

8.3.1 Calibrate the GC for static headspace soil gas analysis by hand-injecting the volumes of stock gas standard shown above into the system.

8.3.2 Calibrate the GC for static headspace water analysis by injecting liquid calibration standards into 15 mL of analyte free water in the 30 mL autosampler vial and crimp seal. Transfer the calibration standard to the water matrix using a gastight syringe and crimp seal immediately. Analyze the resulting sealed standards by autosampler.

8.3.3 Calibrate the GC for static headspace soil analysis by injecting liquid calibration standards into 5 g of analyte free soil matrix (Ottawa Beach Sand or equivalent) in a 30 mL autosampler vial and crimp seal. Transfer the calibration standard to the soil matrix using a gastight syringe and crimp seal immediately. Analyze the resulting sealed standards by autosampler.

8.4 Gas chromatographic analysis: introduce volatile compounds into the gas chromatograph using static headspace EPA Method 3810 by autosampler or hand inject following heating block volatilization.

8.4.1 Table 1 summarizes the estimated retention times of the organic compounds analyzed using this method.

8.4.2 If the response for a peak is off-scale, i.e., beyond the calibration range of the standards, prepare a dilution of the sample and re-analyze or analyze a one point calibration standard above the signal magnitude of the sample response to ensure the calibration factor is in linearity at this level.

9.0 QUALITY CONTROL

9.1 Each laboratory that uses this method is required to operate a formal quality control program. The minimum requirements of this program consist of an initial demonstration of laboratory capability and an ongoing analysis of spiked samples to evaluate and document data quality. The laboratory must maintain records to document the quality of data that is generated. On-going data quality checks are compared with established performance criteria to determine if the results of analyses meet the performance characteristics of the method. When results of sample spikes indicate a typical method performance. A quality control check standard must be analyzed to confirm that the measurements were performed in an in-control mode of operation.

9.1.1 The analyst must make an initial, one-time, demonstration of the ability to generate acceptable accuracy and precision with this method. This ability is established by analyzing a blind PE sample while being overseen by the laboratory director. Results of the blind PE sample must agree within specified EPA limits.

9.1.2 In recognition of advances that are occurring in chromatography, the analyst is permitted certain options to improve the separations or lower the cost of measurements. Each time such a modification is made to the method, the analyst is required to repeat the demonstration of ability PE sample analysis.

9.2 Calibration Factor (CF) Calculations: Before analyzing samples or mobilizing the GC unit to the field, the analyst must prepare calibration standards at a minimum of five concentrations levels for each compound as previously discussed. As stated, one of the calibration standards should be at a concentration near, but above, the MDL. The other concentrations should correspond to the expected range of concentrations found in the "real-world" sample or the establishment of the GC dynamic range. Quality control ranges for the CFs are discussed below.

9.3 Prior to any calibration curve standard analyses, a method blank analysis must be performed where the system is checked for background contamination. Using analyte free materials (water, soil, or inert gas) analyze a blank sample using the method GC temperature program for the presence/absence of background contaminants in either a soil, water, or gaseous matrix. Blank analyses are also performed at a rate of 10% or one/day.

9.3.1 Corrective Action: If background contamination is found, a process of elimination approach must be taken to isolate the source of the contamination. This process of elimination should include the GC column, GC inlet, injection syringe, injection syringe plunger, sample container cap, sample container, and analyte free matrix in that order. Prior to any analyses (calibration or site samples) the system must be found to be free of any outside sources of contamination.

9.4 Calibration factor measurement: Analyze the five calibration standards and calculate the calibration factor at for each compound at each concentration using the following equation:

$$CF = A_x \div C_x \text{ where,}$$

A_x = area of the analyte peak

C_x = analyte concentration in $\mu\text{g/L}$

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If the CF value is constant (i.e., $\leq 30\%$ relative standard deviation, RSD) and the correlation coefficient is near 1 (≥ 0.990) over the dynamic range, the CF can be assumed to be invariant and the average of the CF value(s) can be used for quantitation. Percent relative standard deviation is measured as follows:

$$\%RSD = (\sigma/x) \times 100 \text{ where,}$$

σ = the standard deviation of the distribution

x = the average value of the measurements

9.4.1 Corrective Action: The average CF values must be within 30% RSD and correlation coefficient ≥ 0.990 prior to any sample analyses. If the average CF values for any analyte falls outside of the 30% RSD window, the instrument must be checked for proper flow rates, syringe penetration, heating of the headspace vials, and detector condition prior to analyzing the point or points skewing the curve.

9.5 The working calibration curve or must be verified each working day (at the beginning and end of each day) by measurement of the analyte calibration factor at the mid-point of the initial calibration curve if the sample analysis concentrations are unknown. If the expected sample concentrations are known to be low or high, the CF should be checked at the second or fourth concentrations, respectively. If the CF is within 30% difference from the average CF from the initial five point calibration curve, the instrument is shown to be in calibration. Therefore, it is not necessary to generate a new five point calibration curve on a daily basis. It is recommended that a new five point curve be generated on a monthly basis as a preventative maintenance diagnostic tool. Calibration factor values differing by more than 30% difference for the low and/or high calibration points from the initial calibration curve indicates the integrity of the standard solution has been compromised or the operating parameters of the instrument have changed over time or preventative maintenance must be performed on the GC and/or detector.

9.5.1 Corrective Action: If the calibration factor for any compound varies from the initial calibration curve calibration factor by more than $\pm 30\%$, the test must be repeated using a fresh calibration standard at a second concentration. If any of the analyte CFs calculated from this second point fall outside of the 30% window, a new five point calibration curve must be established. The two previous points can be used as part of this calibration curve if the CFs are consistent. If the new calibration curve CFs do not yield the above stated results, the instrument must be checked for proper flow rates, syringe penetration, heating of the headspace vials, and detector condition and the experiment must be repeated.

9.6 Duplicate analysis is performed at a rate of 10% or one/day. When possible, the duplicate is chosen which was found to contain target analyte. In such cases, it is preferable (time permitting) to perform triplicate analysis and establish measurement precision criteria. Triplicate analysis measurements must result in a 30% RSD. Duplicate analysis should result in a 30% RPD where RPD is measured as:

$$RPD = (\delta/y) \times 100 \text{ where,}$$

δ = the absolute value of the difference between the duplicate measurements.

y = the mean of the two measurements.

9.6.1 Corrective Action: If either duplicate or triplicate analysis criteria fails, the instrument must be checked for proper flow rates, syringe penetration, heating of the headspace vials, and detector condition and the experiment must be repeated unless the analyte results are sufficiently close (3x) to the method detection limit for that analyte.

9.7 The analyst should monitor both the performance of the analytical system and the effectiveness of the method in dealing with each sample matrix by spiking each sample, standard, and reagent water blank with surrogate compounds recommended to encompass the range of the temperature program used in this method. Prepare the surrogate spike at a concentration at the midpoint of the linear range of the instrument for the analyte selected. For the set of compounds listed above, an appropriate surrogate compound would be 1,1,1-Trifluorotoluene. Recovery limits for the surrogate have been established by the EPA in Method 8000. Laboratory specific values should be generated after analyzing 20 samples of the given matrix with the surrogate compound injected. Warning and control levels are calculated as follows:

Upper Warning Level: $\rho + 2\sigma$

Lower Warning Level: $\rho - 2\sigma$

Upper Control Level: $\rho + 3\sigma$

Lower Control Level: $\rho - 3\sigma$, where

ρ = the average quantitated concentration of the 20 analyses

σ = the standard deviation of the 20 analyses

9.7.1 Corrective Action: If the surrogate fails, the instrument must be checked for proper flow rates, syringe penetration, heating of the headspace vials, and detector condition and the experiment must be repeated. Samples with surrogate recoveries outside of the EPA or laboratory derived limits must be re-analyzed or flagged as estimated on the final data reporting sheet using an H (high) or L (low) flag.

9.8 Static headspace preparation and analysis: For water samples, calibration and QC procedures must be performed using methanol based standards spiked into 15 mL analyte free water blanks. For sample analysis, 15 mL of water sample is syringe transferred from the 40 mL VOA vial into the 30 mL sample analysis crimp top vial and crimp sealed. The water sample injection volumes should be sufficient to ensure proper detection at the experimentally determined MDL's (i.e., 800 μ L). Surrogates should be added as needed. It may be necessary to centrifuge the 40 mL VOA prior to withdrawing the sample aliquot to avoid introduction of suspended solids into the sample analysis vial.

For soil samples, calibration and QC procedures must be performed using methanol based standards spiked into 5 g analyte free soil blanks in a 30 mL sample analysis crimp top vial. For sample analysis, 5 g of soil sample is quickly transferred from the sample container into the sample analysis crimp top vial and crimp sealed. The sample soil quantity should be sufficient to ensure proper detection at the experimentally determined MDL's. Surrogates should be added as needed.

For soil gas samples, all QC procedures must be performed by direct injection of gaseous standards when using either direct injection or autosampling of samples as previously discussed. The sample should be directly injected from the

collection container (either Tedlar bags or 30 mL crimp top vials) whenever possible. Injection volumes should be sufficient to ensure proper detection at the experimentally determined MDL's (i.e., 800 µL).

9.9 For sample analysis results, identify the analytes in the sample by comparing the retention times of the peaks in the sample chromatogram with those of the peaks in the standard chromatograms. The width of the retention time window used to make identifications should be based upon measurements of actual retention time variations of standards over the course of a day. Three times the standard deviation of the retention time window is used as a guideline, however, the experience of the analyst should weigh heavily in the interpretation of the chromatograms.

9.10 Additional QC implemented will include field duplicates and field blanks when available. When doubt exists over the identification of a peak on the chromatogram, confirmation techniques such as gas chromatography with a dissimilar column, specific element detector, or mass spectral analysis should be implemented.

10.0 CALCULATIONS

10.1 Determine the concentration of individual compounds in the sample by using calibration factors (CFs) as follows:

$$\text{Concentration } (\mu\text{g/L}) = A_x \div C_f \text{ where,}$$

A_x = area of the analyte peak

C_f = calibration factor as previously defined

10.2 Report results in µg/L without correction for surrogate recovery data. All QC data obtained should be reported with the sample results unless otherwise requested by the client. All results, run logs, maintenance logs, calibration results, notes, chromatograms, and electronic data should be filed for easy access and future reference. Final client reports must be prepared and sent to the client the same day or next morning. One copy of the final report should be filed with all previously mentioned data and a second report should be given to the laboratory director to answer any client questions in the event the analyst is not available.

300699

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Table 1. Calibration curves, calibration factors, and %RSD for EPA Method 3810 static headspace sample introduction and EPA Method 8010 analysis of halogenated volatile organics by gas chromatography.

Soil Gas Analysis											
	Stock Conc. (µg/L)	Cal. Point 1 (µg/L)	Cal. Point 2 (µg/L)	Cal. Point 3 (µg/L)	Cal. Point 4 (µg/L)	Cal. Point 5 (µg/L)	Cal. Factor (ave.)	Cal. Factor (%RSD)	Ave. R _s (min.)	R _s (±)	r ²
Benz	349	1.14	11.4	22.9	34.3	45.8	0.0672	6.3	2.66	0.30	0.999
EB	454	1.49	14.9	29.9	44.8	59.7	0.0490	3.3	6.50	0.30	0.999
Tol	411	1.35	13.5	27.0	40.5	53.9	0.0535	2.8	4.57	0.30	0.999
m,p-X	944	3.10	31.0	62.0	93.0	124	0.0423	4.4	6.69	0.30	0.998
o-X	440	1.51	15.1	30.2	45.2	60.3	0.0431	4.0	7.13	0.30	0.999
Soil Headspace Analysis											
Benz		10	200	400	600	800	0.0139	35	2.66	0.30	0.993
EB		10	200	400	600	800	0.0129	22	6.50	0.30	0.999
Tol		10	200	400	600	800	0.0124	21	4.53	0.30	0.999
m,p-X		10	200	400	600	800	0.0242	9.0	6.68	0.30	0.999
o-X		10	200	400	600	800	0.0128	7.0	7.13	0.30	0.999
Water Headspace Analysis											
Benz		10	200	400	600	800	0.0156	4.4	2.66	0.30	0.998
EB		10	200	400	600	800	0.0208	5.0	6.50	0.30	0.998
Tol		10	200	400	600	800	0.0178	4.2	4.57	0.30	0.999
m,p-X		10	200	400	600	800	0.0383	11	6.68	0.30	0.998
o-X		10	200	400	600	800	0.0177	8.3	7.13	0.30	0.998

300700

APPENDIX G
TYPICAL BLANK WATER ANALYSIS

300701



ENVIROTECH RESEARCH, INC.

300702

777 New Durham Road
Edison, New Jersey 08817
Tel: (908) 549-3900
Fax: (908) 549-3679

FAX TRANSMISSION COVER PAGEDATE: 6/11/97TO: Mike MetlitzCOMPANY: WhitmanFAX NUMBER: 908-390-9496

SUBJECT: _____

FROM: Mike Urban
ENVIROTECH RESEARCH, INC.TOTAL NUMBER OF PAGES TRANSMITTED INCLUDING COVER PAGE: 9

IF ALL PAGES ARE NOT RECEIVED PLEASE TELEPHONE (908) 549-3900.

MESSAGE:

Client ID: LAB FB H2O
Site:

Lab Sample No: LAB FB H2O
Lab Job No:

Date Sampled: _____
Date Received: _____
Date Analyzed: 05/27/97
GC Column: DB624
Instrument ID: VOAGC1.i
Lab File ID: geld6185.d

Matrix: WATER
Level: LOW
Purge Volume: 5.0 ml
Dilution Factor: 1.0

VOLATILE ORGANICS - GC/ELCD
METHOD 601

<u>Parameter</u>	<u>Analytical Result</u> <u>Units: ug/l</u>	<u>Detection</u>
		<u>Limit</u> <u>Units: ug/l</u>
Dichlorodifluoromethane	ND	0.44
Chloromethane	ND	0.55
Vinyl Chloride	ND	0.14
Bromomethane	ND	0.39
Chloroethane	ND	0.33
Trichlorofluoromethane	ND	0.36
1,1-Dichloroethene	ND	0.25
Methylene Chloride	ND	0.26
trans-1,2-Dichloroethene	ND	0.28
1,1-Dichloroethane	ND	0.28
cis-1,2-Dichloroethene	ND	0.50
Chloroform	ND	0.23
1,1,1-Trichloroethane	ND	0.24
Carbon Tetrachloride	ND	0.26
1,2-Dichloroethane	ND	0.19
Trichloroethene	ND	0.25
1,2-Dichloropropane	ND	0.19
Bromodichloromethane	ND	0.16
2-Chloroethyl Vinyl Ether	ND	0.86
cis-1,3-Dichloropropene	ND	0.27
trans-1,3-Dichloropropene	ND	0.28
1,1,2-Trichloroethane	ND	0.10
Tetrachloroethene	ND	0.28
Dibromochloromethane	ND	0.07
Chlorobenzene	ND	0.35
Bromoform	ND	0.20
1,1,2,2-Tetrachloroethane	ND	0.21
1,3-Dichlorobenzene	ND	0.23
1,4-Dichlorobenzene	ND	0.22
1,2-Dichlorobenzene	ND	0.19

300703

Client ID: LAB FB H2O
Site:

Lab Sample No: LAB FB H2O
Lab Job No:

Date Sampled: _____
Date Received: _____
Date Analyzed: 05/07/97
GC Column: DB624
Instrument ID: VOAMS7.i
Lab File ID: v2031.d

Matrix: WATER
Level: LOW
Purge Volume: 5.0 ml
Dilution Factor: 1.0

VOLATILE ORGANICS - GC/MS
METHOD 624

<u>Parameter</u>	<u>Analytical Result</u> <u>Units: ug/l</u>	<u>Detection</u> <u>Limit</u> <u>Units: ug/l</u>
Chloromethane	ND	0.9
Bromomethane	ND	0.3
Vinyl Chloride	ND	0.4
Chloroethane	ND	1.0
Methylene Chloride	ND	1.0
Acetone	ND	5.0
Carbon Disulfide	ND	1.0
1,1-Dichloroethene	ND	0.6
1,1-Dichloroethane	ND	0.3
trans-1,2-Dichloroethene	ND	0.3
cis-1,2-Dichloroethene	ND	1.0
Chloroform	ND	0.2
1,2-Dichloroethane	ND	0.2
2-Butanone	ND	5.0
1,1,1-Trichloroethane	ND	0.2
Carbon Tetrachloride	ND	0.2
Bromodichloromethane	ND	0.2
1,2-Dichloropropane	ND	0.5
cis-1,3-Dichloropropene	ND	0.3
Trichloroethene	ND	0.4
Dibromochloromethane	ND	0.2
1,1,2-Trichloroethane	ND	0.4
Benzene	ND	0.2
trans-1,3-Dichloropropene	ND	0.3
Bromoform	ND	0.3
4-Methyl-2-Pentanone	ND	5.0
2-Hexanone	ND	5.0
Tetrachloroethene	ND	0.1
1,1,2,2-Tetrachloroethane	ND	0.3
Toluene	ND	0.2
Chlorobenzene	ND	0.1
Ethylbenzene	ND	0.2
Styrene	ND	1.0
Xylene (Total)	ND	1.0

300704

Client ID: LAB FB H2O
Site:

Lab Sample No: LAB FB H2O
Lab Job No:

Date Sampled: _____
Date Received: _____
Date Extracted: 05/08/97
Date Analyzed: 05/13/97
GC Column: DB-5
Instrument ID: BNAMS4.i
Lab File ID: u5253.d

Matrix: WATER
Level: LOW
Sample Volume: 1000 ml
Extract Final Volume: 2.0 ml
Dilution Factor: 1.0

SEMI-VOLATILE ORGANICS - GC/MS
METHOD 625

<u>Parameter</u>	<u>Analytical Result</u> <u>Units: ug/l</u>	<u>Detection</u> <u>Limit</u> <u>Units: ug/l</u>
Phenol	ND	1.1
2-Chlorophenol	ND	2.1
2-Methylphenol	ND	5.0
4-Methylphenol	ND	5.0
2-Nitrophenol	ND	3.1
2,4-Dimethylphenol	ND	2.8
2,4-Dichlorophenol	ND	2.9
4-Chloro-3-methylphenol	ND	2.8
2,4,6-Trichlorophenol	ND	3.0
2,4,5-Trichlorophenol	ND	5.0
2,4-Dinitrophenol	ND	5.7
4-Nitrophenol	ND	1.2
4,6-Dinitro-2-methylphenol	ND	4.0
Pentachlorophenol	ND	2.5

300705

Client ID: LAB FB H20
Site:

Lab Sample No: LAB FB H20
Lab Job No:

Date Sampled: _____
Date Received: _____
Date Extracted: 05/08/97
Date Analyzed: 05/13/97
GC Column: DB-5
Instrument ID: BNAMS4.i
Lab File ID: u5253.d

Matrix: WATER
Level: LOW
Sample Volume: 1000 ml
Extract Final Volume: 2.0 ml
Dilution Factor: 1.0

SEMI-VOLATILE ORGANICS - GC/MS
METHOD 625

Parameter	Analytical Result Units: ug/l	Detection Limit Units: ug/l
bis(2-Chloroethyl)ether	ND	1.2
1,3-Dichlorobenzene	ND	3.4
1,4-Dichlorobenzene	ND	3.5
1,2-Dichlorobenzene	ND	3.4
bis(2-chloroisopropyl)ether	ND	1.4
N-Nitroso-di-n-propylamine	ND	1.5
Hexachloroethane	ND	2.4
Nitrobenzene	ND	1.5
Isophorone	ND	1.7
bis(2-Chloroethoxy)methane	ND	1.6
1,2,4-Trichlorobenzene	ND	3.7
Naphthalene	ND	2.5
4-Chloroaniline	ND	5.0
Hexachlorobutadiene	ND	2.1
Benzo(g,h,i)perylene	ND	0.7
2-Methylnaphthalene	ND	5.0
Hexachlorocyclopentadiene	ND	1.6
2-Chloronaphthalene	ND	3.1
2-Nitroaniline	ND	5.0
Dimethylphthalate	ND	1.3
Acenaphthylene	ND	2.0
2,6-Dinitrotoluene	ND	1.5
3-Nitroaniline	ND	5.0
Acenaphthene	ND	2.8
Dibenzofuran	ND	5.0
2,4-Dinitrotoluene	ND	1.5
Diethylphthalate	ND	1.2
4-Chlorophenyl-phenylether	ND	2.8
Fluorene	ND	1.9
4-Nitroaniline	ND	5.0
N-Nitrosodiphenylamine	ND	1.1
4-Bromophenyl-phenylether	ND	2.0
Hexachlorobenzene	ND	1.2
Phenanthrene	ND	1.0

300706

Client ID: LAB FB H2O
Site:

Lab Sample No: LAB FB H2O
Lab Job No:

Date Sampled: _____
Date Received: _____
Date Extracted: 05/08/97
Date Analyzed: 05/13/97
GC Column: DB-5
Instrument ID: BNAMS4.i
Lab File ID: u5253.d

Matrix: WATER
Level: LOW
Sample Volume: 1000 ml
Extract Final Volume: 2.0 ml
Dilution Factor: 1.0

SEMI-VOLATILE ORGANICS - GC/MS
METHOD 625

<u>Parameter</u>	<u>Analytical Result</u> <u>Units: ug/l</u>	<u>Detection</u> <u>Limit</u> <u>Units: ug/l</u>
Anthracene	ND	1.1
Carbazole	ND	5.0
Di-n-butylphthalate	ND	1.0
Fluoranthene	ND	1.1
Pyrene	ND	0.6
Butylbenzylphthalate	ND	0.7
3,3'-Dichlorobenzidine	ND	1.4
Benzo(a)anthracene	ND	0.8
Chrysene	ND	0.9
bis(2-Ethylhexyl)phthalate	ND	1.1
Di-n-octylphthalate	ND	1.0
Benzo(b)fluoranthene	ND	0.7
Benzo(k)fluoranthene	ND	0.9
Benzo(a)pyrene	ND	0.8
Indeno(1,2,3-cd)pyrene	ND	0.7
Dibenz(a,h)anthracene	ND	0.8

300707

Lab Job No: LAB FB H20

Date Sampled: N/A
Date Received: N/A
Matrix: WATER

Date Analyzed: 6/10/97

TOC

Envirotech <u>Sample #</u>	Detection <u>Limit</u>	Analytical Result <u>Units: mg/l</u>
LAB FB H20	1.0	ND

300708

Lab Job No: LAB FB H20

Date Sampled: N/A
Date Received: N/A
Matrix: WATER

Date Analyzed: 6/10/97

PHC

Envirotech <u>Sample #</u>	Detection <u>Limit</u>	Analytical Result <u>Units: mg/l</u>
LAB FB H20	1.0	ND

300709

Client ID: N/A
Site: N/A

Lab Sample No: DIWATER
Lab Job No: N/A

Date Sampled: 06/10/97
Date Received: 06/10/97

Matrix: WATER
Level: LOW

METALS ANALYSIS

Analyte	Analytical Result Units: ug/l	Instrument Detection Limit	M
Aluminum	ND	48.5	P
Antimony	ND	2.2	P
Arsenic	ND	2.2	P
Barium	ND	0.20	P
Beryllium	ND	0.20	P
Cadmium	ND	0.30	P
Calcium	ND	46.1	P
Chromium	ND	1.1	P
Cobalt	ND	1.1	P
Copper	ND	1.8	P
Iron	ND	34.5	P
Lead	ND	2.1	P
Magnesium	ND	45.7	P
Manganese	ND	0.20	P
Mercury	ND	0.10	CV
Nickel	ND	1.4	P
Potassium	ND	22.5	P
Selenium	ND	3.2	P
Silver	ND	1.0	P
Sodium	ND	22.8	P
Thallium	ND	3.1	P
Vanadium	ND	0.80	P
Zinc	ND	1.4	P

M Column - Method Code (See Section 2 of Report)

300710

APPENDIX H

NJDEP METHODOLOGY FOR THE FIELD EXTRACTION/PRESERVATION OF SOIL SAMPLES WITH METHANOL FOR VOLATILE ORGANIC COMPOUNDS

300711



DRAFT

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION
METHODOLOGY FOR THE FIELD EXTRACTION/PRESERVATION OF SOIL
SAMPLES WITH METHANOL FOR VOLATILE ORGANIC COMPOUNDS
FEBRUARY 1997

1.0 Scope and Application

1.1 This method describes the container preparation, field sampling and field extraction/preservation procedure to be used in conjunction with the analysis of soil samples for volatile organics. The applicable analytical methods are SW-846 methods 8010B, 8015A, 8020A, 8021A, 8240B and 8260A found in the most recently promulgated edition of USEPA's Test Methods for Evaluating Solid Waste and the most current version of the Statement of Work for Organic Analysis, Multi-Media, Multi-Concentration, USEPA Contract Laboratory Program.

1.2 It is the laboratory's responsibility when analyzing samples obtained by this method to demonstrate internally that all NJDEP soil cleanup criteria for VOC's (last revised on 2/3/94, as contained in the April 1994 NJDEP Site Remediation News, Volume 6, Number 1, pages 13, 17-19) have been achieved. Should a laboratory know or suspect it has inadequate analytical sensitivity to meet any of the cleanup criteria, the laboratory shall not accept any samples unless the Department is notified in advance and the laboratory obtains approval.

2.0 Method Summary

2.1 Soil samples collected for volatile organic analysis must be handled in a manner which will minimize the loss of contaminants due to volatilization and biodegradation. Department experience and open literature indicate that, for the analysis of volatile organic compounds in soil, field extraction/preservation with methanol must be conducted to ensure that contaminants do not degrade or volatilize during sample handling and transport.

2.2 A small diameter soil core sampling device is used to collect a 10 gram (g) soil sample. The sample is extruded into a tared sample container, supplied by the laboratory performing the analysis, containing purge and trap grade methanol and surrogate compounds. The ratio of volume of methanol to weight of soil is 2.5:1. A portion of the methanol extract is combined with organic free reagent water and analyzed by purge and trap GC or GC/MS.

3.0 Sample Containers

3.1 The recommended sample containers are a 60 ml (2 oz.) wide mouth packer bottle, a 60 ml straight sided wide mouth bottle and a 40 ml or 60 ml VOA vial. All sample containers should have

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a open-top screw cap and a silicone rubber coated with Teflon^R septa or other similar sample container. Some similar containers with Teflon^R lined screw caps have shown to be susceptible to leakage. The type of container used should be tested to ensure leakage will not occur during shipment. ¹

The use of larger volume containers will cause the layer of methanol over the sample to be minimized, making it difficult to extract an aliquot of methanol for analysis.

3.2 The standard 40ml or 60ml VOA vial can be used, but the small mouth may not accommodate some core samplers. The VOA vial is also unstable and susceptible to spillage.

4.0 Sample Container Preparation

4.1 Label each sample container with a unique numerical designation.

4.2 Fill the sample container with 25 mls of demonstrated analyte free purge and trap grade methanol.

4.3 An actual analysis should be traceable to the methanol used in the sample containers on the day the sample containers were prepared.

4.4 Record the lot number of the methanol used in the preparation of the sample containers. This information can be used for future reference in the event of suspected contamination of the methanol.

4.5 Employing a syringe, add the appropriate surrogate compounds to the methanol based on the analytical method. For methods 8010B, 8015A, 8020A, and 8021A, add each surrogate compound to the methanol yielding a concentration of approximately 1500 ug/l in each sample container. For methods 8240B, 8260A and the Medium Level Soil/Sediment Sample procedure of the Contract Laboratory Program Statement of Work, add each surrogate compound to the methanol yielding a concentration of approximately 2500 ug/l in each sample container.

4.6 Immediately cap the container tightly and gently swirl.

4.7 Variations of the surrogate compounds may be used depending upon expected sample matrix interferences and contaminants.

4.8 Weigh each labeled sample container with the 25 mls of methanol and surrogate compounds to the nearest one tenth (0.1g) of a gram.

4.9 Record the weight in a bound logbook and on the chain of custody record with its corresponding numerical designation.

4.10 All sample containers must be supplied by the laboratory performing the analysis.

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4.11 The prepared sample containers must be stored at $4^{\circ} \pm 2^{\circ}\text{C}$ before shipment. The sample containers should be prepared no more than fourteen (14) days prior to shipment. It will be the responsibility of the laboratory to ensure the integrity of the sample containers remain contaminant free.

5.0 Sample Collection Methodology

5.1 Soil sample collection for volatile organic analysis must be performed with the use of a decontaminated small diameter coring device. A modified 10-30 ml disposable syringe or commercially available small diameter tube/plunger sampler is acceptable. The small diameter coring device must be capable of collecting the required amount of sample from larger diameter core samplers (split spoons, etc.) or from freshly exposed soils.

5.2 Selection of the sample location for volatile organics must be based on the methods in the NJDEP Field Sampling Procedures Manual, May, 1992 and the site specific sampling plan.

5.3 If a modified disposable syringe is used it can be prepared in-house by cutting off the injection tip. Depending upon the construction of the syringe, small air vents must be cut into the plunger or the rubber tip and retaining post must be removed. These alterations to the plunger will prevent air from being forced through or around the soil plug during subcoring and sample extrusion.

5.4 The small diameter core sampler must be capable of delivering the sample directly into the sample container. The outer diameter of the core sampler must be smaller than the inner diameter of the sample container to avoid loss of sample and ease the soil transfer process. **The sample from the small diameter core cannot be transferred to a secondary container such as another sample bottle, zip lock bag, aluminum foil, etc. prior to placement into the sample container with the methanol preservative.**

5.5 Use a small electronic balance or manual scale for measuring the weight of the soil in the syringe. The scale must be calibrated before use, and intermittently the calibration should be checked during the sampling day to ensure accuracy of the weight measurements.

5.6 Tare weigh the small diameter core sampler.

5.7 Once the sampling interval has been selected, trim off the surface soils of the sample interval to expose a fresh soil surface. The loss of volatile organics from the surface soils will occur if the soil has been exposed for a short period of time (during screening, etc.). The removal of the surface soils can be accomplished by scraping the soil surface using a decontaminated spatula or trowel. The sampling procedure must commence immediately once a fresh soil surface has been exposed.

5.8 Using a decontaminated coring device, collect $10\text{g} \pm 2\text{g}$ (8-12grams) of sample (wet weight). Wipe the outside of the subcoring device to remove any adherent soil. The plunger of the coring device can be pulled back or completely removed allowing the open barrel of the subcore to be inserted into the soil. Depending upon the soil texture, depth or moisture content, the subcore can

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be inserted straight into the soil, on an angle or multiple insertions can be performed to obtain the required sample weight.

5.9 Quickly weigh the sample while contained in the small diameter core sampler. Excess soil sample can be removed from the coring device by extruding a small portion of the core and cleaning away with a decontaminated trowel or spatula. **If soil weight is below the weight limit, obtain additional sample. Reweigh after each addition or removal of sample to the subcore until the target weight is attained (8-12g). Analytical results from a sample exceeding the weight maximums and minimums may be rejected and thus require resampling.**

5.10 When sampling soils consisting of similar textures and water content, sample weight can be estimated based on volume of previously weighed samples from sampling or practice core sampling to determine sample weights.

5.11 Immediately open the sample container and slowly extrude the soil core into the preweighed and prenumbered sample container supplied by the laboratory performing the analysis. Avoid splashing methanol out of the sample container. Do not insert the small diameter coring device into the mouth of small diameter sample containers (40ml or 60ml VOA vials) or immerse the small diameter soil coring device into the methanol.

5.12 Ensure the threads on the sample container and cap are free of soil particles. Use a clean brush or paper towel to remove the particles off the threads. The presence of soil particles compromises the seal of the container resulting in loss of methanol which may invalidate the sample.

5.13 Secure the lid of the sample container. Gently swirl the sample to mix and break up the soil aggregate until soil is covered with methanol. **Do not shake.**

5.14 Do not attach any additional adhesive backed labels or tape to the sample containers. Record sample numbers on container avoiding covering laboratory identification number. Labels with wire or rubber band attachments may be used provided they can be removed easily for sample weighing. Record laboratory and field identification numbers on chain of custody and field notes.

5.15 The actual weight of soil will be determined by the laboratory performing the analysis.

5.16 Do not use or submit samples for analysis if any methanol has spilled from a sample container during shipment to the site or during sampling. Extra sample containers can be made available by the laboratory in case of accidental spillage of methanol in the field. The sample containers must be prepared in accordance with Section 4.0.

5.17 After sample collection, immediately return the containers to an iced cooler in an upright position. Sample containers can be placed in separate ziplock bags to protect other containers in case of leakage during transport. The laboratory sample number or field sample identification number may be placed on the bag and crossed referenced on the Chain of Custody. Do not place additional adhesive backed labels or tape on the sample containers. If any methanol is lost from a

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sample container upon arrival at the laboratory, the sample is invalid and resampling must be performed.

6.0 Moisture Determination

6.1 To report the sample results on a dry weight basis, collect one duplicate sample not preserved with methanol from each sample location for moisture determination. Tightly seal the container to prevent the loss of soil moisture. This sample does not require to be weighed or preserved with methanol. A small volume sample container (15 mls or less) may be used for this sample to avoid possible sample shortages.

6.2 Weigh a 5-10g portion of the sample in a tared crucible.

6.3 Dry the sample overnight at 103-105 °C. Allow to cool in a desiccator before reweighing.

6.4 Determine percent dry weight by the following formula:

$$\% \text{ dry weight} = \frac{\text{g of dry sample}}{\text{g of sample}} \times 100$$

6.5 Calculate sample concentration on a dry weight basis.

7.0 QA/QC Sample and Decontamination Requirements

7.1 Ambient Blank

7.1.1 An Ambient Blank is a QA/QC sample which will determine the potential contamination from ambient air during sampling procedures. This sample will provide a means to evaluate non-sample related contamination.

7.1.2 The Ambient Blank is prepared in the same manner as the sample containers described in Section 4.0. During sample collection, it is opened at the same time and next to the sample container and remains open during sample collection. It is closed at the same time as the sample container. It is performed at only one sample location in an area suspected of having the highest ambient contamination.

7.1.3 The collection of an Ambient Blank is not required when sampling is performed using the methanol extraction/preservation technique. It will be optional at the discretion of the site investigation team, or will be required on a site specific basis if previous elevated analytical results are suspected due to contamination from the sampling environment.

7.1.4 If Ambient Blanks are employed, the frequency of collection should be one (1) per day or at the discretion of the investigation team based on site conditions.

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7.1.5 Results of the Ambient Blank must be reported as a solid sample where a sample weight of 10g and 100% dry weight is assumed.

7.2 Field Blank

7.2.1 A Field Blank is a QA/QC sample which will determine potential contamination from sampling equipment used to collect and transfer samples from the point of collection to the sample container.

7.2.2 A Field Blank is performed by pouring demonstrated analyte free water from one sample container, over each piece of sampling equipment required for sample collection and into a separate set of identical sample containers. Additional information on Field Blanks can be found in the NJDEP Field Sampling Procedures Manual, May 1992.

7.2.3 A Field Blank is not required when sampling with the methanol extraction/preservation technique. It is optional, or will be required on a site specific basis if previous elevated analytical results are suspected due to cross contamination from sampling equipment.

7.3 Trip Blanks

7.3.1 A Trip Blank is a QA/QC sample which will determine additional sources of contamination that may potentially influence the samples. The sources of the contamination may be from the lab, sample bottles or during shipment.

7.3.2 A Trip Blank is prepared at the same time and in the same manner as the sample containers as described in Section 4.0. The Trip Blank must accompany the sample containers to the field and back to the laboratory along with the collected samples for analysis. It must remain sealed at all times until it is analyzed at the laboratory.

7.3.3 A Trip Blank is required when sampling with the methanol extraction/preservation technique. It will be required due to potential cross contamination from sample shipment or from handling at the laboratory.

7.3.4 The frequency of collection for the Trip Blank must be at a rate of one (1) per sample shipment.

7.3.5 Results of the Trip Blank must be reported as a solid sample where a sample weight of 10g and 100% dry weight is assumed.

7.4 Duplicate Samples

7.4.1 Perform duplicate samples at a rate of five (5) percent (1 per 20 samples).

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7.4.2 Duplicate samples must be obtained from the same location and soil type to minimize location as a potential source of variation in the analytical results. Separate core samples should be obtained for the sample and duplicate sample.

7.5 Sample and Sample Container Handling Time

7.5.1 Sample handling time is to control the length of time bottles are shipped to the site and held on site. The standard four (4) day handling time for sample containers and samples remains the same. Obtain additional information on handling times from Chapter 2 in the NJDEP Field Sampling Procedures Manual, May 1992.

7.5.2 As stated in N.J.A.C. 7:26E-2.1(a)15, samples must be delivered to the laboratory no later than 48 hours after sample collection.

7.6 Decontamination of Sampling Equipment

7.6.1 All equipment used for sampling must be decontaminated prior to use.

7.6.2 Decontamination of sampling equipment must follow the procedures in the NJDEP Field Sampling Procedures Manual, May 1992 for soil sampling equipment. If modified disposable syringes are utilized, they should be discarded if the three step cleaning procedure will not remove the contamination since exposure to acetone may damage the sampling tool.

7.7 General Quality Assurance

7.7.1 Quality assurance requirements have been established to maintain sample integrity. Their primary objectives are to maintain the physical form and chemical composition of the sample and to prevent contamination from other sources or cause changes in contaminant concentrations. Chapter 2 in the NJDEP Field Sampling Procedures Manual, May 1992 may be consulted for further details on other sampling QA/QC criteria and procedures.

8.0 Field Analysis

8.1 Field analytical methods may be employed during an investigation to aid in the selection or elimination of samples for laboratory analysis. When collecting samples for field analysis, collect a duplicate sample for laboratory analysis. This prevents returning to a sample location and resampling at a later time. Any methanol preserved samples not submitted for laboratory analysis are a hazardous waste and must be disposed of on-site or by the laboratory according to State and Federal regulations. To avoid this problem, the following procedure can be used:

8.1.1 Using the sampling method in section 5.0, use an EnCore^R core sampler to obtain a duplicate sample for laboratory analysis. Store the soil for laboratory analysis in the core sampler by sealing the end(s) of the core with the end caps supplied with the EnCore^R sampler. **Eliminate headspace in the sampler.**

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8.1.2 Label the core for lab analysis and immediately cool the sample. The core sample may be stored at 4°C on ice for a maximum of six (6) hours prior to preserving with methanol. This intermediate storage method can only be used if samples are field analyzed.

8.1.3 Perform the selected field analytical procedure on the duplicate sample and document the field analysis in accordance with the NJDEP Field Analysis Manual, July 1994.

8.1.4 If soil from a sample location is selected for laboratory analysis, preserve the iced core sample with methanol. Samples must be preserved with methanol within the six (6) hour field holding time.

8.1.5 Use this procedure only when performing field analysis of the samples (i.e. Field GC, Immunoassay, etc.).

9.0 Laboratory Analysis

9.1 Upon arrival of the sample at the laboratory, weigh the sample container to the nearest one tenth (0.1g) of a gram to determine the weight of soil placed in the sample container.

9.2 Subtract the weight of the container, methanol and surrogates from the total weight of the sample container with the soil sample. This gives the wet weight of the soil sample.

9.3 Proceed with the analysis of the sample using the "high concentration" methodology of the requested SW-846 analytical method or the "Medium Level Soil/Sediment Samples" procedure of the USEPA Contract Laboratory Program Statement of Work. In both instances, start the analytical procedure at the point where approximately 1ml of methanol extract is to be transferred to storage.

9.4 Using the non-methanol preserved duplicate sample, determine the dry weight of the sample.

10.0 Shipping Procedures

10.1 Methanol is considered a hazardous material therefore shipping of the sample containers is regulated by the U.S. Department of Transportation and the International Air Transport Association (IATA). The rules of shipment set in Title 49 of the Code of Federal Regulations (49 CFR parts 171 to 179) and the current edition of the IATA Dangerous Goods Regulation must be followed when shipping methanol between the laboratory and the field. Consult the above documents or the shipping company for additional information.

10.2 The shipment of the quantity of methanol used for the sample preservation falls under the exemption for small quantities. A summary of the requirements for shipping samples follows. Refer to the code for a complete review of the requirements.

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10.2.1 The maximum volume of methanol in a sample container is limited to thirty (30) mls.

10.2.2 The sample container must not be full of methanol.

10.2.3 The sample container must be stored upright and have the lid held securely in place. The mechanism used to hold the cap in place must be able to be completely removed so weight is not added to the sample container.

10.2.4 Sample containers must be packed in a sorbent material capable of absorbing spills from leaks or breakage of the sample containers.

10.2.5 The maximum sample shuttle weight must not exceed 64 pounds.

10.2.6 The maximum volume of methanol per shipping container is 500mls.

10.2.7 The shipper must mark the sample shuttle in accordance with shipping dangerous goods in acceptable quantities.

10.2.8 The package must not be opened or altered until no longer in commerce.

11.0 Safety

11.1 Methanol is a toxic and flammable liquid. Therefore, methanol must be handled with all safety precautions related to toxic and flammable liquids. Inhalation of methanol vapors must be avoided. Vials should be opened and closed quickly during the sample preservation procedure. Methanol must be handled in a ventilated area. Use protective gloves when handling the methanol vials. Store methanol away from sources of ignition such as extreme heat or open flames. The vials of methanol should always be stored in a cooler with ice at all times.

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